The Science Teacher

Mechanical "hands" of this remote-control manipulator are used in radioactive areas and are able to perform delicate chemical experiments.
(Courtesy General Electric Company)

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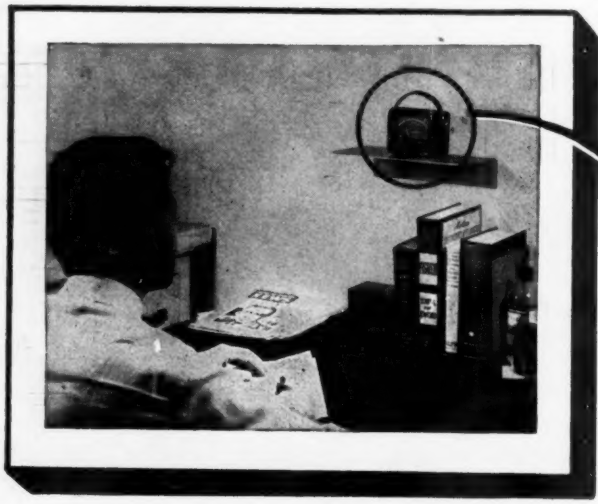

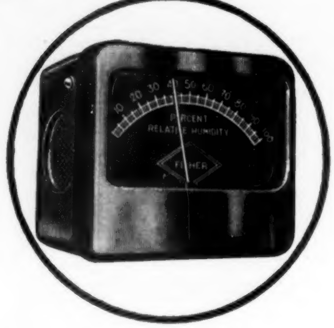

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The Science Teacher

VOLUME XVI APRIL, 1949 NUMBER 2

What Problems Are Involved in the Inservice Training of Teachers?[1]

FRANCIS D. CURTIS
University of Michigan

THE FINDINGS of several investigations seem to justify the startling conclusion that teachers improve in competence during about the first seven years of service and then become increasingly incompetent. A plausible explanation of this disquieting discovery is that during their earlier years in the classroom, teachers are encountering new problems which keep them alert; but that after seven years they have met the usual situations and have learned how to cope with them. Hence, they no longer have either the incentive or the realization of the need to seek improvement. Therefore, their competence deteriorates.

Such a condition can be remedied only through inservice training. If, however, the investigational results referred to be valid, then it must be reluctantly admitted that the means of inservice training now in use fail to function adequately. These means include most prominently (1) post-baccalaureate study, (2) conferences and workshops, and (3) teachers' institutes.

Let us examine these briefly:

1. Accrediting agencies and school authorities everywhere are exerting pressure upon teachers to take post-baccalaureate work in colleges and universities in order to validate a permanent certificate or to secure a master's degree. In order to stimulate the veteran teachers who have already earned the master's degree, some administrators require every member of their corps to take a summer session's work at some institution of higher learning every three or five years. Such instances, however, are sporadic—so much so, in fact, that it may be stated positively that teachers who take college work beyond the bachelor's degree are predominantly the younger ones. These neophytes validate certificates or secure the master's degree during their first years of teaching. Thereafter most of them take no further courses.

Not only is the post-baccalaureate college work unevenly distributed among the members of teaching staffs, but often it is not of the sort which would improve teaching competence maximally. Teachers need both subject-matter and further professional training. In mapping their study programs, however, they commonly elect courses in education in preference to those in subject-matter. In many, if not in most cases, they take only as much more subject-matter as the institution in which they are studying demands of them. Moreover, the subject-matter that they take is frequently not selected in terms of their needs. The typical teacher of high-school science needs broad, rather than narrowly specialized, training. Yet the majority of teachers tend to take more courses in the branches of subject-matter in which they have majored as undergraduates rather than to take any courses in branches which they may be called upon to teach but in which they have had little or no training. In justice to these teachers, however, it should be stated that in many cases the fault here lies not wholly with them. Many would like to take elementary courses in science, but they feel that they cannot afford to do so because such courses will not give them credit towards a master's degree.

2. Conferences and workshops are profes-

1 Delivered as part of the panel on *Problems of Science Teacher Training*, in a joint session of the NSTA, NABT, NCES, Section Q (AAAS) and ANSS, at Washington, D. C., December 29, 1948.

sionally salutary. They provide real advantages to the teacher who wishes to become better qualified for her work.

3. Teachers' institutes are a long established and almost universal institution; yet they probably increase teacher competence to an extent far below their potentialities. In the first place, many teachers do not regard an institute as primarily a means of improving their craftsmanship. They think of it as a break in routine or a semi-holiday. In the second place, institute speakers are commonly chosen on the basis of their willingness to speak rather than on their ability to make a valuable contribution.

MOST OF what has been said up to this point is destructive criticism. Such criticism has value for appraisal, but in itself offers little which might effect improvement. What can be done to improve inservice training? Some suggestions may be worth considering:

1. The plan of holding workshops and conferences before the beginning of the school year, or at other suitable times, is worthy of wider adoption. Such conferences can be maximally and optimally valuable, however, only if conducted under the guidance of experts who are competent both in the subject-matter and in the pedagogy with which the teachers are concerned.

2. Supervision all but disappeared from schools and school systems during the depression of the thirties and it has not since regained its former status. It should, however, be extended as rapidly and as broadly as possible for nothing improves instruction as substantially as does consistent, persistent, and expert supervision. By supervision is meant not merely classroom visits and follow-ups, vital and salutory as these can be made to be, but also conferences, discussions, and all other phases of modern supervision.

IN THE SMALLER schools, which are the typical ones, the principal or the superintendent (who is commonly both superintendent and principal) must do whatever supervision is done. He needs, therefore, to be trained to supervise, and his training must be such as to ensure his competence to offer substantial, constructive help to his staff-members even in the subject-mater fields in which he did not specialize. It is, therefore, the responsibility of the teacher-training institutions to make certain that such training for supervision is available and is practical.

In the larger school systems, department heads should have supervision as a major responsibility. A primary consideration, therefore, in the selection of department heads should be their training and the experience they have had which together can be expected to make them competent supervisors. It should be stressed, moreover, that the most competent supervisor cannot accomplish his mission unless he is given a regularly scheduled and generous amount of time in which to do it.

3. The plan, such as that instituted by the University of Oregon of sending expert consultants out into the state, each to remain for several weeks in one location where he is constantly available to administrators, curriculum committees and teachers to provide help and guidance, has great merit and enormous potentialities for inservice training.

4. Several investigations indicate that the typical teacher does little professional reading. In her defense, it is only just to state that she cannot afford to spend much of her income on books and magazines. It is the legitimate responsibility of boards of education and administrators, therefore, to provide the newest and best professional materials in both the general and the various subject-matter fields. If such materials are made readily available to staff members, then an able administrator can do much to stimulate professional reading by encouraging presentations and discussions of important books and articles as a regular part of the teachers' meetings.

5. Merely to provide professional publications and to encourage staff members to read them is not enough. These stimuli will help to keep teachers professionally alive but will not keep them sufficiently up to date in their knowledge of educational developments, because there is far too much material to be read. The mass of professional literature must be reduced to a point where its assimilation by busy teachers is practicable. There is

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Using Nature Literature in School Programs[1]

GLENN O. BLOUGH

Specialist for Science,
Elementary Division
U. S. Office of Education

THE GENERAL theme of this conference has been designated as "Meeting the Needs of Society through Science Education." Specifically this section meeting of the American Nature Study Society is to deal with "Nature Literature For Children." This particular discussion is to treat briefly the problem of *Using Nature Literature in School Programs.*

In this discussion we shall interpret nature to be a study of the physical and natural world that surrounds children and young people. We shall consequently think not only of books about plants and animals, but also about books describing the phenomena of weather, astronomy, light, sound, magnetism and similar areas as well.

It is essential, it would seem at the outset, to think briefly about the purpose such books are to serve in achieving the general goal of meeting the needs of society through science education. What are these needs of society? They could be stated in a hundred ways and we could discuss at length which are the most essential needs to be served. We won't. For the sake of establishing a direction to go and a purpose to which we can tie nature books let us name four needs of society.

WE WOULD probably all agree that we need a better informed society. It would be more difficult for us to agree on just what this information should be, but certainly more information about the world in which we live is a crying need of our children and young people.

A society whose members are better able to solve their problems would be truly a great accomplishment. We all get into plenty of deep water because we come out with the wrong answer to problems we must grapple with in day-to-day living. To cite but a few problems just look at those dealing with conservation, and with safe and healthy living.

We need a society composed of people with a better attitude toward each other. We need persons willing to approach a problem with an open-minded attitude, willing to change their minds in the face of convincing evidence, willing to settle an issue on the basis of facts instead of prejudices, and willing and able to select reliable sources of information. These are but a few of the elements that must be compounded into an attitude essential to members of today's society.

CLOSELY allied with this we need a society composed of individuals with an understanding of the meaning of a democracy and adjusted to assuming their share of responsibility for serving and belonging as well as being ready to reap its rewards—individuals who are growing in understanding the meaning of being citizens of the world, too. as well as of their own counties, states and nation.

These needs obviously overlap. Let's not quibble about that. They do, and in all probability we have left out additional needs as important as these if not more so. At least these needs help to establish a purpose for using nature books as part of a school program. Let us now note briefly some of the ways of using nature literature in school programs so that they can contribute to these needs.

In the first place, selecting, ordering, unpacking, cataloguing and shelving books, does not in any way insure their proper use. These are essential but they are only the beginning. Getting them into the hands of children—the right book for the right child is most important. Since we are dealing in this discussion chiefly with supplementary books and not text materials, this presents something of a problem. How can we connect children with nature books that will interest them? First we must become aware of the interests of children, then become acquainted with the book titles that will serve these interests. For example, in a class discussion of the problem of how animals live together some pupils will be more than a little interested in the social life of bees, ants and termites. The class discussion will stimulate and broaden their curiosity, the supplementary reading will help to satisfy it by giving additional detailed in-

1. Presented at Annual Meeting, American Nature Study Society, Washington, D. C., December, 1948.

formation to the pupils who want it. Hooking the supplementary reading to the regular work in science is then one way to insure greater use of appropriate books.

IN CONNECTION with their interest in science, children often bring things to school, especially if they are encouraged to do so. The things they bring range all the way from rocks to rabbits, and generally they are interested to find out something about them, especially if there has been a brief class discussion that raised questions. Books again may come to the rescue.

Current newspaper accounts often stimulate interest of children in scientific phenomena. For example, the frequent reference to atomic energy has stimulated pupils to ask about atoms and molecules. Again there are supplementary books that can help to satisfy this interest.

Children's hobbies are often excellent sources from which to identify interest in further study from books. An insect collection is an example. Some collections we all know have a brief but brilliant career ending in a jumble of wings and legs in the bottom of a cigar box, but some collected by children turn into real learning situations. Their owners want identification and informational books to guide them.

In each of the foregoing examples of interest manifestations, the right book can contribute greatly to the broadening of the interest and consequently to the enjoyment and satisfaction derived from it.

BUT EVEN after the right book finds it way into the hands of the right child, there's still the big problem of helping the child use the book to the best advantage. Most children need at least some guidance to get accurate information, to tie the information to the problems at hand, to interpret statements and understand vocabulary. Generally speaking, the textbooks used by the children present less difficulty with these problems than do supplementary books. Consequently, the need for assistance is even more marked. Adults who work with children have a responsibility to help them to get the most information possible from the science books they read, with the greatest possible pleasure and satisfaction.

In supplementing books there is also the problem of making some of the ideas in them come alive by suggesting things to do to concrete them. For example, a pupil interested in growing plants may find books to his liking. To understand better how seeds sprout and grow, how plants grow under different conditions and how they change as they develop, pupils may devise and perform experiments and make observations with various amounts of help from the teacher. Such a procedure makes the reading more meaningful and the activity more intelligent.

IN SUMMARY then, using supplementary science books with pupils entails selecting the book that will hit the spot with the pupil, then helping him to get what he wants from the book and assisting him in making some appropriate use of the information. All of this must be keyed to the purposes cited earlier for using books to meet the needs of society—a society of individuals better informed, better able to solve problems, with a better attitude toward each other and toward the democratic way of life.

Selecting the right book and guiding its use will help children and young people grow into better informed adults provided the information gained is appropriate to fit the needs of the reader—information which will help him adjust to the world which surrounds him because of his understanding of relationships, processes and phenomena.

Under guidance, books may help pupils grow in ability to solve problems provided they are aware of the process involved. Here certainly there is need for guidance—in judging the authenticity of the book, reading it with accuracy, interpreting carefully and comparing it with other sources of information.

Desirable attitudes, too, may develop through the use of books but again only with direction. Books that show how scientists work to be sure that their information is relibale may contribute toward a more scientific attitude on the part of pupils. The importance of certain words and phrases may take on new and important meaning if children learn to read science books thoughtfully. Examples: it is generally believed, some scientists think,

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Science Curriculum Development in Japan

V. V. EDMISTON

Science Curriculum Specialist

Dr. Edmiston has been in Japan for some time directing the revision of the science curriculum. He will return to the United States this summer. You will be interested in the rapid progress made in modernizing science education.—Editor.

DURING the period of the occupation, science teaching in elementary and secondary schools of Japan has been changing its focus from science subject matter to how science is taught. Abilities and interests of pupils are gaining greater recognition in educational planning. Instead of "telling" and lecturing, problem solving is emphasized. Increasing attention to audio-visual materials results in greater use of radio programs, film strips, and moving pictures as well as field trips and laboratory demonstrations. Although class size is still very great with fifty to sixty pupils to a classroom, teachers are encouraged to think about individual pupils and especially to think of working with small groups rather than with classes as a whole.

Several projects of national scope have contributed to improved science teaching, namely:

Development and revision of the course of study in science.

Elementary science curriculum project.

Secondary science curriculum project.

Science education research rooms.

Science textbook production.

Each of these projects will be described briefly in this article. All of them are meant for furthering the development of science teachers in service. Science education research rooms further teacher understanding of problem solving through scientific research; the other projects further understanding of science content and of such aspects of professional education as child development and methods of teaching.

IN JAPAN growth of teachers in service is especially important because the limited economic resources of the country have been reflected in limited pre-service preparation of teachers. It is not out of the ordinary to find an elementary school teacher with eleven years, or a secondary school teacher with fourteen years of schooling. In the occupation period, improved pre-service teacher education has been emphasized at the same time that stress has been put on in-service development.

Both potential and actual teachers of science benefit from bulletins and pamphlets prepared by national, regional, prefectural and local leaders in science education; and from such magazines as "Science and Education,"[1] a new monthly magazine featuring selected articles in English translated into Japanese, and "The Education of Science,"[2] a monthly magazine that resumed publication after the war and now features work of curriculum study groups in Japan. Such publications will be increasingly useful as they deal more with the teaching of pupils and less with logically organized science topics. Teachers need material that requires a minimum of reworking to make it immediately useful to pupils.

Growth of science teachers has also been furthered by confernces sponsored by local, prefectural, regional and national groups interested in science education. Increasingly these conferences have gotten away from the usual lectures and have come to have greater audience participation. Panel discussions, demonstrations followed by discussions, and training conferences in which the entire group or subgroups carry on training activities, are now familiar conference methods.

Course of Study

AN EARLY step in curriculum development was the making of the first course of study for Japan. This general project included a course of study in science to implement the newly organized science curriculum which is as follows:

Elementary School: Grades 1 to 3— Science teaching without textbook.

Secondary School: Grades 4 to 6—Science teaching with textbooks.

Grades 7 to 9—General Science.

Grades 10 to 12—One of the following sciences: biology, chemistry, physics, physical

1—Kagaku to Kyoiku.
2—Kagaku Kyoiku.

geography.

A course of study was developed for general science, grades 1 through 9. This course of study paralleled the other volumes in the course of study in having four parts:

1. *A statement of aims in science teaching* including (a) understandings, (b) attitudes, (c) critical thinking, especially problem solving, and (d) other skills.

2. *A description of the development of children showing their interests and abilities in science.* This statement was necessarily rather general because there is not yet a body of psychological educational research to show child development accurately and specifically.

3. *Methods of teaching science in successive grade levels.* This included suggestions for activities in keeping with subject aims and with children's development for each grade level.

4. *Suggestions for evaluating pupil progress in line with aims of science teaching.* This course of study was developed within a short length of time because of the great need for it in the field. Subsequent revisions will be one means of furthering in-service teacher development.

Elementary Curriculum Project

IN THE summer of 1947 it was possible to begin curriculum development from the grass roots throughout Japan. First, the central committee of leading scientists and leading science educators from the Tokyo area met once a week. They defined aims—what was to be expected of children at each grade level. These were grouped under four subject heads, namely: (1) living things (plants and animals); (2) the sky and the universe; (3) machines and tools; (4) health. In each of these areas, lists of generalizations were developed for each grade level. Next, attitudes and skills, including critical thinking, were defined in like detail. Before the central committee adjourned, its discussion had included many suggestions for activities and materials appropriate to develop the desired aims. All of these materials will be exceedingly useful in the revision of the course of study for elementary grades as well as for the use of textbook writers.

Immediately the materials were useful to the regional and local committees cooperating on the project. Regional chairmen met as part of the central committee from time to time. They were well able to go ahead in organizing regional committees to lead in local curriculum developments.

During the school year in 1947-1948 and 1948-1949 these regional groups have encouraged a variety of projects including:

A. The development and printing of science booklets for kindergartens through grades 6.

B. Advising local schools in working out their own science curriculum within the framework of the national course of study.

C. Conferences of elementary and secondary teachers interested in improving their science teaching.

D. Publishing monthly or quarterly or special periodicals for teachers.

E. Furthering cooperation in use of laboratory equipment.

Secondary Curriculum Project

WITH curriculum work well underway at the elementary level it is possible now in 1949 to extend curriculum development into the secondary school. A central committee has been formed and again the work of this committee will fan out into the regional and local work, extending it into secondary school problems.

As a new feature, the secondary curriculum project includes an evaluation study as an integral part of it. Last fall a study of teacher views about the usefulness of and needed improvements in the course of study was begun by the development of questionnaires regarding five elementary school subjects and five secondary school subjects. Science was one of the subjects at both the elementary and secondary levels. The questionnaires were distributed throughout Japan to those schools where the teachers wished to review their experience with the course of study and to report both their experience and their opinions. When these teacher views have been summarized in March and April, they should be of use in curriculum projects. The central committee of the secondary curriculum project will make use of the questionnaire data before finishing the courses of study in June.

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Experiments in Illumination

W. E. MILLER

Assistant Professor, University of Illinois

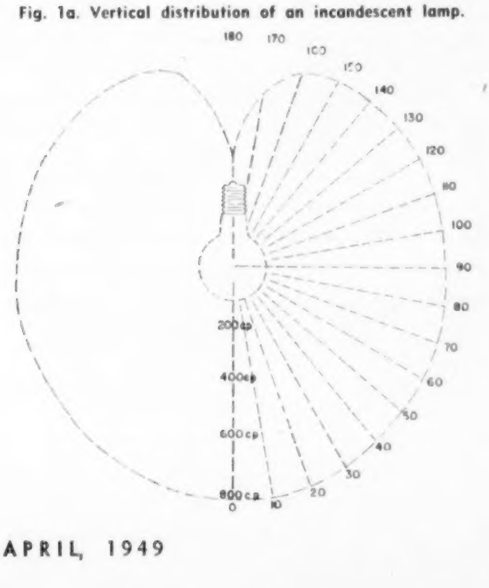
Introduction

THE LIGHT emitted by a source of illumination is not uniform in all directions. A three dimensional polar graph of the luminous intensity of a bare incandescent lamp will resemble the shape of an apple, while that of a bare fluorescent lamp will resemble the shape of a doughnut. (See Figures 1a and 1b.) By placing these lamps in suitable reflectors or luminaries, the bare lamp distributions can be concerted into more efficient and more usable form. To describe the distribution of light from a source of illumination, whether it be a bare lamp or a luminaire, it is necessary that the relationship between the intensity (candlepower) of the source and the angular displacement about the source be known. This relationship is called a candlepower distribution curve and is usually presented in two dimensional form on polar coordinates in a vertical plane. To determine this relationship, a distribution photometer is used, one type of which is described in this paper.

Recommended Equipment

1. Foot-candle meter.
2. Distribution photometer similar to the one shown in Fig. 2.
3. Several sources of illumination including a bare incandescent lamp, an incandescent lamp luminaire, a fluorescent lamp luminaire, etc.

Fig. 1a. Vertical distribution of an incandescent lamp.



Discussion of Procedure

THE PORTABLE distribution photometer shown in Figure 2 uses a foot-candle meter[1] to determine the illumination in foot-candles[2] at any desired angular displacement about the source and at a definite distance from the source. From the inverse square law (See Figure 3)

$$E \text{ (illumination in ft. candles)} = \frac{\text{intensity (candle power)}}{\text{(distance in feet)}^2}$$

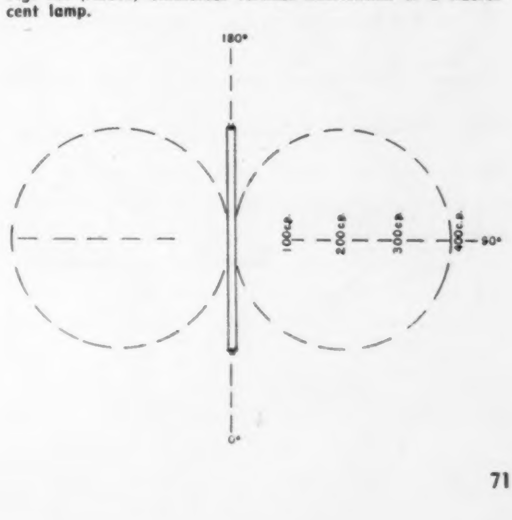
it is possible to calculate the intensity of the source at any particular angle. Revolving the foot-candle meter about the source in a vertical plane, the intensities of the source at 5 degree or 10 degree intervals can be obtained from which a vertical distribution curve can be plotted on polar coordinates.

The horizontal distribution of the source can be obtained by placing the meter at 90° (horizontal position) and rotating the source about a vertical axis. The same procedure as outlined above is then used to determine the intensities of the source at 5 degree or 10 degree intervals in the horizontal plane.

1—To use the foot-candle meter accurately, the correction factors described in Article II of this series (*The Science Teacher*, Vol. XVI, No. 1, Feb., 1949) must be applied to the readings.

2—A foot-candle is the illumination on a surface one square foot in area on which there is a uniformly distributed flux of one lumen. (*American Standards Assoc.* Z 7.1-1942, para. 05.040)

Fig. 1b. (Above) Sinusoidal vertical distribution of a fluorescent lamp.



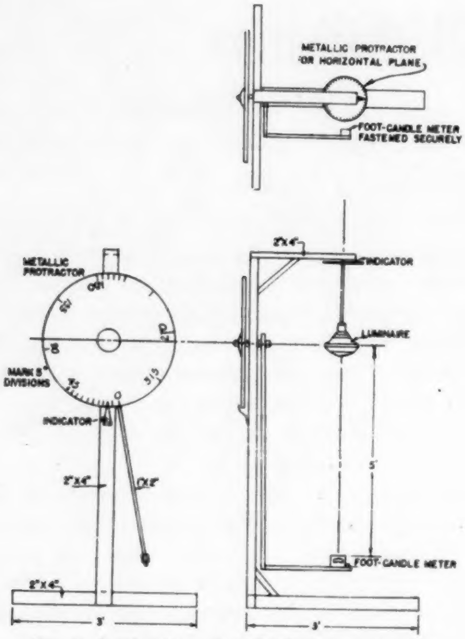


Fig. 2. Construction of a distribution photometer.

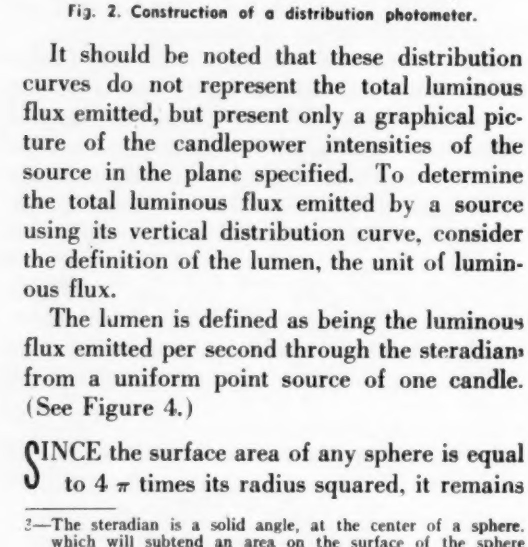
It should be noted that these distribution curves do not represent the total luminous flux emitted, but present only a graphical picture of the candlepower intensities of the source in the plane specified. To determine the total luminous flux emitted by a source using its vertical distribution curve, consider the definition of the lumen, the unit of luminous flux.

The lumen is defined as being the luminous flux emitted per second through the steradian[2] from a uniform point source of one candle. (See Figure 4.)

SINCE the surface area of any sphere is equal to 4 π times its radius squared, it remains that any sphere must contain 4 π steradians. A standard candle placed at the center of the sphere will then provide one lumen per steradian; in other words, a standard candle will emit a total luminous flux of 4 π lumens. The total luminous flux emitted by the source then must be equal to 4 π times the mean spherical candlepower of that source. Similarly, it can be stated that the luminous flux emitted by a source through any solid angle is equal to the product of the average candlepower intensity of the source in that solid angle and the steradians contained in that solid angle.

2—The steradian is a solid angle, at the center of a sphere, which will subtend an area on the surface of the sphere equal to the radius of the sphere squared.

Fig. 3. Fundamental illustration of the inverse-square law.



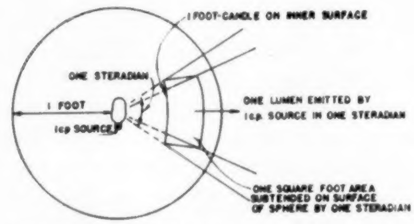


Fig. 4. Showing relationship between fundamental concepts in a unit sphere.

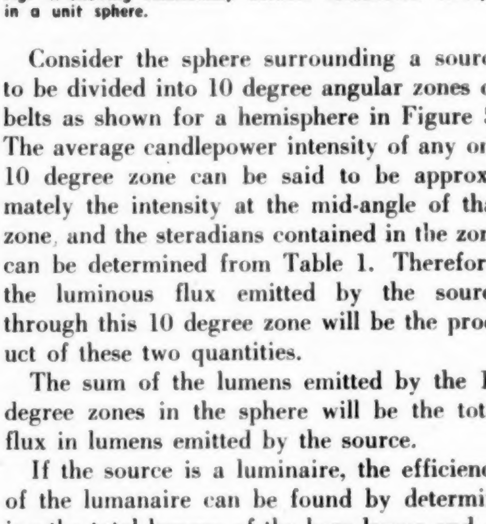
Consider the sphere surrounding a source to be divided into 10 degree angular zones or belts as shown for a hemisphere in Figure 5. The average candlepower intensity of any one 10 degree zone can be said to be approximately the intensity at the mid-angle of that zone, and the steradians contained in the zone can be determined from Table 1. Therefore, the luminous flux emitted by the source through this 10 degree zone will be the product of these two quantities.

The sum of the lumens emitted by the 10 degree zones in the sphere will be the total flux in lumens emitted by the source.

If the source is a luminaire, the efficiency of the lumanaire can be found by determining the total lumens of the bare lamps and of

Continued on Page 94

Fig. 5. A hemisphere divided into 10 degree angular zones.



An Experiment in Education

Challenge Students to Use Science Principles and Break Up Routine Procedures.

CHARLES H. STONE
Vermont Junior College
Montpelier, Vermont

ONE OF THE outstanding events of the tourist season at Orlando, Florida is the annual fair held in February. At this fair a large number of exhibits are shown and among them are those on education.

By arrangement with Professor J. M. Brumbaugh, the writer was privileged to do some special work with his students in chemistry in preparation for exhibits. The procedure was simple. Each candidate was asked to solve a simple little problem not set forth in the text or in the manual in use. Some of these problems follow:

1. What happens when mercury and iodine are ground together?
2. Prove that manganese dioxide is really a catalyst when used with potassium chlorate in the production of oxygen.
3. Thrust a blazing match into a beaker full of kerosene. Explain the effect.
4. Show that sodium nitrate contains much oxygen.
5. Cut a cylinder of charcoal about ¾ inch long and of such size as to slip easily up and down in a six-inch test tube. In the tube boil 5 ml conc ammonium hydroxide; pour out the liquid; thrust the charcoal *up* into the tube; and stand the tube in a dish containing mercury. Explain the results obtained.
6. Pour a few drops of a carbon disulfide solution of yellow phosphorus on the center of a filter paper. Place on a tripod over a wire screen and blow the breath against the wet spot. Explain the spontaneous ignition that follows.
7. What is the effect of low heat on crystal lized copper chloride?
8. Prepare the carbonates of lead, copper, and cobalt.
9. What is the effect of strong heat on the dry carbonates of the metals above?
10. Obtain copper from copper carbonate.
11. Is it possible for an element to have more than one combining number in a given compound? What is the structural formula for red lead?—for magnetite?
12. Does warm dilute nitric acid react with red lead? (Production of lead dioxide is illustrated.)
13. Etch glass, large size, (8″ × 10″).
14. Add KI solution to separate solutions of $HgNO_3$ and $Hg(NO_3)_2$. Explain results.
15. Prepare chrome yellow (pigment).
16. Prepare potassium iodate. Dilute solutions of KIO_3 (containing starch paste) and sulfurous acid are poured together in equal volumes and well shaken. What happens in a few minutes? Explain.

When the candidate has solved the problem assigned, he places samples of the substances used and the products obtained in small test tubes and mounts these on colored cardboard or exhibits his work in any other pleasing way. Then he writes a little booklet telling the story of his experiment together with equations and any other pertinent material.

Pupils who have engaged in this work have been much interested, for the problem puts them in the attitude of a discoverer rather than a verifier, the latter being the position in which the laboratory worker is generally placed.

A typical pupil report follows.

Effect of Heat on Copper Chloride Crystals

Copper chloride crystals are green. They have the formula $CuCl_2 \bullet 2H_2O$.

I heated about five grams of the crystals in a dry tube clamped almost level, with the open end a little lower than the closed end. Moisture was given off when low heat was used. The green color gradually disappeared until at last only a tan-colored substance was left.

I dried out the tube with rolled filter paper and poured out the dry residue ($CuCl_2$) and preserved it.

Edited by JOSEPH SINGERMAN

• A department in which science is presented in its close relationship to the individual and in which guidance is given in causing the individual to recognize the methods of science and its vast social implications.

Danger in Fluorescent Lamps

JOSEPH SINGERMAN
High School of Commerce
New York City

DANGER to you lurks inside the fluorescent lamp. Like some other technical boons to modern living, this one too is exacting its toll in human suffering.

I have in my possession copies of unpublicized warning bulletins issued by large national corporations for the attention of their own employees. One of these organizations is well known, not only in the electric industry, but also to the public. That publicity, outside of their own organizations, has been carefully avoided, is demonstrated by a notation on one of them indicating that it was not to be posted on the bulletin boards. The notices are dated several months prior to the writing of this article.

Danger lies in the possibility of being cut by fragments from a broken fluorescent tube or of inhaling phosphor dust. The phosphor is the coating on the inside of the tube which fluoresces under excitation by ultraviolet radiation from the electrified mercury vapor when the lamp is in operation. The pathological effect is loosely referred to as beryllium poisoning, and is caused by compounds of beryllium. The phosphor in fluorescent lamps, and in some other well known devices too, is zinc beryllium silicate. Beryllium poisoning has been known to cause death.

SYMPTOMS resulting from contamination are delayed, sometimes for years. "The prognosis of the disease is poor," reports *Industrial Hygiene Digest* of December, 1948, in summarizing a report by the British Dr. J. M. Agate, "treatment is ineffectual and the disability may be serious and permanent." Following a delay of onset, where the lungs are affected, there is ulceration, dramatic weight loss, dyspnea (breathing difficulty), long duration of illness, sometimes death.

Superficial Laceration Develops Tumor

In September, 1947, a girl received what was considered to be a "minor superficial laceration" from a shattered fluorescent lamp. Ordinary first aid was applied. I shall quote reference to this case as reported to a meeting of the American Association of Industrial Physicians and Surgeons, at the Massachusetts General Hospital in Boston, early in 1948. "The wound healed only partially and continued to break down and discharge a weak watery solution. The employee also noticed a ridge of small tumor-like tissue growth along the wound line but she continued to work and unfortunately neglected professional attention. About January 30 (1948) a bulletin was issued by the general office covering the possible hazard in fluorescent tubes."

Dr. Robert S. Grier, of the Cancer Committee, Harvard, reporting on previous cases, stated, ". . . the granulomas in the skin are very similar to the granulomas that one sees in the lungs of people who have died from the chronic pulmonary form of granulomatosis and who have worked with fluorescent lamp powders." Similar observations were made in other medical reports.

SUSCEPTIBILITY to beryllium poisoning apparently varies widely, but I could find no venture of opinion on possible conditions of sensitization.

Beryllium was suspected, as indicated in reports from abroad, as early as 1933. First American reports were issued ten years later. Bulletin 181 of the United States Public Health Service, in 1943, did not consider beryllium metal itself as toxic, but that "sol-

uble compounds were irritating because of hydrolysis and should not be inhaled." This was, to say the least, a conservative statement. Although appreciable thought and attention has been given this problem since, the hazard was apparently not brought to the attention of industrial workers till the latter part of 1948, judging by the company notices in my possession. That the matter has not been brought to public attention is, in my opinion, a result of unwise decision.

Disposal of Burned-Out Fluorescents

Disposal of burned-out fluorescent lamps presents a problem. The company bulletin quoted above gives the following advice.

"(1) Never discard burned-out fluorescent lamps by placing them with rubbish or refuse (persons may pick them up and accidentally break them). Never destroy them by placing them in incinerators.

"(2) Smash all lamps before disposing of them, and keep the broken glass wet or covered with water in the disposal receptacle.

"(3) Where there is only an occasional lamp to be destroyed, place it in the sleeve or carton from which the new lamp has been removed, take it out of doors, and then smash it. Wear gloves and goggles during this operation.

"(4) Where larger quantities of lamps are to be destroyed, a smashing device should be installed." (A plan is supplied for the construction of such a device).

"(5) When emptying the rubbish can, always stand on the windward side of the can, even though the broken glass is wet." (No hint is given as to what the garbage collector is to do after this material presumably is deposited on his collection truck.—Ed.)

Not All Phosphors Contain Beryllium

THESE disclosures bring into suspect various devices in home and school utilizing phosphors. Not all phosphors, however, contain beryllium. Some television screens do contain zinc beryllium silicate. One prominent manufacturer assures me that this compound is no longer used in the larger screens, because of its lower efficiency at high voltage, but is being used in those of seven inch diameter and smaller. One would, however, want to check more definitely with each manufacturer. I do not believe that it is used in the oscilloscope or radar screens. In the first place, I have not found affirmative information in the literature. Secondly, the beryllium compound reduces the efficiency of the screen. Its use in television is necessitated by the need in this application of a white fluorescence, the yellow component of which is provided by the beryllium compound.

A leading manufacturer of luminous paints informs me that the beryllium salt is not used in such preparations. That is because beryllium requires a wavelength much shorter than the 3650 Angstroms of the ultraviolet used to excite these paints.

In contrast to this, note the following formula in Bennett's *Chemical Formulary*. volume 6, page 552. "Billows simulating fire can be made by blowing zinc beryllium silicate into a beam of ultraviolet light." Do you have a sense of humor? The formulary goes on to say, "Dyes should not be used since they stain garments and skin."

WORKERS engaged in the manufacture of beryllium and its compounds must be equipped with foolproof safeguards. This is not a kind of infection which the body can, in small doses, eliminate. Each particle, at least in the susceptible person, does its measure of permanent damage. Among industrial uses of beryllium, in addition to those mentioned, are: alloys, radio tubes, incandescent lamps, neon sign tubing, electric heating elements, luminescent indicators, refractories (beryllium silicate, beryllium oxide), vitreous enamels, gas mantels (beryllium nitrate), textile fibers.

In conclusion, I would emphasize the need for publicity of the hazard of possible beryllium poisoning, not only among industrial workers, but also in home, school and office where dangerous appliances are in use. But I should point out that the facts do not warrant panic or rash action. Do not ask youngsters to bring burned-out fluorescent lamps to school. Do not attempt to salvage such tubing for laboratory use, as has frequently been suggested.

A Science Fair—Its Organization and Operation

(Concluded from February issue.)

NORMAN R. D. JONES
Southwest High School
St. Louis, Missouri

Factors in Planning a Fair

Area. The territory from which entries are accepted must be determined; such as, city schools only, metropolitan area or whatever is easily accessable for bringing exhibits to the fair. As the name Greater St. Louis Science Fair implies the metropolitan area of Missouri and three Illinois counties adjacent to St. Louis (a 30 to 40 mile radius) were selected as the territory from which exhibits might be entered. Entries were accepted from the kindergarten through high school (12th year) from public, private and parochial schools.

Date of Fair. The best time for holding the fair according to the judgment of our committee is as late in the school year as possible. This gives more time for classes of the second semester to develop exhibits. If it is held too late in the year, it might cause interference with school closing activities. Easter vacation was used last year since that time would cause the least interference for physical education classes normally held in the field house

Publicity. An announcement must be developed so that the students may be informed as to the many procedures to be followed in making and showing exhibits. Samples of the various forms, instructions, etc., to serve as a guide for use can usually be secured from places having held fairs. *Science Service*, 1719 N. Street, N. W., Washington 6, D. C., has a complete file on the Providence, Washington, D. C., and St. Louis Fairs which may be borrowed for a few days to serve as a reference to give you some ideas concerning the materials, needs, nature of exhibits, publicity, etc.

The Fields of Entry. The divisions for entries—biology, physics, chemistry, on elementary, junior and senior levels—must be determined. Judging standards, safety rules and closing date of entries are a few of the factors to be specified in your brochure of announcement.

Printed Material. It is very difficult to estimate the total needs of each type of printed material. It is much more economical to print extra copies of each type than to have to have re-prints (as we did). With the brochure of information, mentioned above, an attractive poster for the bulletin board should be sent to each school room in the area, to attract the attention of students, teachers, etc. Frequent contact through additional publicity material sent to the various schools keeps their attention focused on the fair.

Entry blanks in sufficient quantity to keep a surplus in each school room is very desirable and encouraging.

After the committee has had time to secure "awards" (cash, merchandise, etc.) another poster can be sent out announcing and describing the specific awards.

Registration cards (3) for files (used in checking exhibits in and out as well as for record purposes) can be made out and mailed to the exhibitor shortly before the time of the fair.

Also with the above cards an entry card is enclosed, which can be folded and sealed for judging purposes and later opened for awards and information about the exhibitor for those viewing exhibits.

In order not to "sail under false pretense" a card was prepared for information for purposes of judging stating which parts were not made by the student but were borrowed, purchased, donated, etc. This card also is displayed with the project.

A scoring card (at least 3 for each exhibit) was prepared for the judges to use in scoring each entry.

A judge's signature card was developed to be placed with each exhibit, to determine when three judges had scored it (each individually against the standard printed in the brochure of announcement of the fair).

Each person having an entry was given an exhibitor's badge to wear. Resultant publicity, distinction, etc., proved them to be very valuable.

Blue, red and gold seals (1st, 2nd and 3rd

grant, respectively) were prepared to be attached to folded entry cards, mentioned above, to signify the degree of proficiency of the exhibit according to the opinion of the judges. The scores of all entries were ranked for each division and field. Those ranking in the first fifteen per cent received a blue seal; the second fifteen per cent, a red seal; and, the next thirty per cent, a gold seal, making sixty per cent given a proficiency rating.

A certificate of award with the proper "seal" attached proved to be valued very highly by the high sixty per cent.

Stationery, letterheads, and envelopes (of several sizes) should be attractively designed for correspondence, dispatching or mailing literature, etc.

A number of important signs will be needed in the exhibition hall, such as, table numbers, areas, (biology, physics, etc., for each division), directions for registering entries, "No Smoking," etc.

Time Element. The time element is very important in many phases of the operation of the fair. The receipt of the entry blanks should be early enough (three weeks to a month prior to opening date) to allow sufficient time to care for the many details, such as assignment of space, making out and mailing entry cards to exhibitors, etc.

One or two days should be set aside for arranging tables and bulletin board space for the exhibits.

The first day of the fair should be utilized in checking in and arranging exhibits. Set the closing hour for receiving exhibits early enough so that there will be time enough to seal all the entry cards so that the judges cannot see the names, schools, etc., of the exhibitors.

It will take at least one complete day to judge all exhibits. Under no circumstances should one try to announce winners before the latter part of the fair. It is humanly impossible to get the judging done, to add the grades, and to determine the winners in one day.

The checking out time must be strictly adhered to. Set a special time and do not let any one remove exhibits before then. It would seem advisable not to start taking out exhibits at the close of an evening's program. It is too crowded and everyone is so anxious to leave that undue confusion results. It will take less time to take down exhibits than to set them up so one-half day should be sufficient.

The last half day should be sufficient to clear out tables, bulletin boards, etc., and to clean up the space used.

Exhibit Space. The plotting (lay-out) of the space allotments in the exhibit room is very important. Certain of the "showy" physical science exhibits should have more space between tables for spectators to gather to watch demonstrations. The numbering and laying out of the space made possible by tables, bulletin boards, etc., for the various exhibits takes a great deal of time and planning. Various systems of numbering have been attempted but none to date have proven too satisfactory. Electrical outlets will have to be planned for many of the exhibits. Other details such as police and fire protection, and insurance against accidents by participants and guests should be considered in your planning.

AS YOU CAN readily see, the decision to undertake a science fair is not a decision with minor consequences. If your science teachers' group decides to organize and carry out a fair, the resultant work load will be considerable. Our experience at St. Louis, however, allows us to say positively that the results justify the effort. Your community, your students, and your classroom science programs all will benefit if you undertake the project. Few activities serve so well the science teacher's dual aims of general education in science and location of scientifically talented youth.

(If you are planning a "fair" the author will be glad to furnish you samples of the various forms used.)

Salt: The Aristocrat of Minerals. A 24 page booklet discussing the many forms and uses of salt. International Salt Company, Scranton, Pennsylvania.

This and That

NORMAN R. D. JONES
President, National Science Teachers Association

President's Report

ALL N.S.T.A. activities are progressing very nicely. Immediately ahead is our summer meeting held in conjunction with the National Education Association at Boston on July 4th. A very fine program has been prepared, and I am sure it will be well worth your time to spend a few hours with us.

The board of directors will meet July 2 and 3. You are cordially invited to sit in with us and learn of the many phases of our work.

Since this is the last publication of *The Science Teacher* before my term of office as president expires, I want to express to each and every one of you my sincere thanks for whatever contribution you have made towards making this another very excellent year for N.S.T.A. Without your help it would have been impossible to have accomplished the many things we have been able to do.

Student Membership

The latest additions to our ever growing group of student members include sixteen more from the University of Pittsburgh.

Advisory Council

The Advisory Council Research Committee will be sending a short questionnaire to all members later this spring. Prompt cooperation in filling out and returning the questionnaire will be most helpful to the Committee in its investigation of the problem: how have the N.S.T.A. packet materials been used, and what are the most effective techniques for the use of supplementary teaching aids in science?

Election of Officers

THE nominating committee, as announced in this column in the December issue, under the chairmanship of Dr. Charlotte Grant, has proceeded in a very commendable manner.

1. Each of you, through this column was given the opportunity of suggesting candidates for the various offices.
2. All officers, consultants and officers (in so far as it was possible to ascertain them) of affiliated groups, and various educational leaders of N.S.T.A. were requested to suggest officers.
3. From the list thus compiled the committee made the selections which you will have received by the time this reaches you.

The constitution and by-laws requires all ballots to be returned by May 10th. It is our hope that you will get your ballot mailed in by the above date.

Changes of Address

Mr. Virgil O. Seiser, formerly of Ames, Iowa, is now in Anchorage, Alaska.

Mr. Frederick Jeffs is now teaching at the Banner Bridge Training College at N. Preston, England.

Many others of you will be in new teaching positions with the start of the 1949-50 school year next September. Please notify N.S.T.A. as soon as your new address is determined so that you will be sure to get all our mailings, packets, Science Teacher, etc.

UNESCO

Mr. A. O. Baker, Mrs. Grace C. Maddux and Miss Anna E. Burgess were N.S.T.A. representatives at the recent UNESCO meeting held in Cleveland, Ohio.

West Coast Summer Meeting

THE Annual West Coast Summer Meeting will be held at Oregon State College, Corvallis, Oregon, June 20 and 21, in connection with the Northwest Regional Institute for Science Teachers.

A very worthwhile program has been prepared and all, who possibly can do so, are urged to attend. Dr. Stanley E. Williamson, N.S.T.A. state director, is chairman of the planning committee. He is ably assisted by, Dr. Paul Kambly, Oregon N.S.T.A. area director; and Mr. Clarence Diebel, Miss Irene Hollenbeck, Mrs. Gretchen George and Mr. Bayard Buckham, western area regional vice-president.

Other Meeting Representatives

Dr. John Read represented N.S.T.A. at Boston; Dr. Herbert A. Smith at Lincoln,

Continued on Page 79

N.S.T.A. Annual Summer Meeting

Statler Hotel and Boston University, Boston, July 2-4, 1949

The National Science Teachers Association continues its custom of holding a convention at the time and place of the annual summer meeting of the National Education Association. Science teachers, supervisors, school administrators, and all others interested in science education are invited to participate in the program sessions of N.S.T.A.

PROGRAM

Business Sessions

Saturday, July 2, Statler Hotel

9:30 A. M., Parlor C—Meeting of officers and Board of Directors

2:00 P. M. —Reserved for committee meetings

7:00 P. M., Parlor C—Meeting of officers and Board of Directors

Sunday, July 3, Statler Hotel

9:30 A. M., Parlor C—Meeting of officers and Board of Directors

2:00 P. M., Parlor C—Meeting of officers and Board of Directors

Professional Sessions

N.S.T.A. is a growing professional organization engaged in many lines of activities. There are many problems to be faced and worked out. Officers and committees of N.S.T.A. will introduce some of these activities and problems in today's sessions, but it is hoped that much of the discussion will be supplied by the N.S.T.A. members in attendance. We are looking for "grass-roots" guidance in the formulation of N.S.T.A. policies.

Monday, July 4, Room 50, Science Wing, Boston University, 685 Commonwealth Ave.

9:30 A. M., Norman R. D. Jones, Presiding

"A Statement of Purposes and Progress to Date on the Equipment Study Project."
Walter S. Lapp, Northeast High School, Philadelphia, Pa.

"Report on the 1948 Cooperative Meeting of the Science Teaching Societies of the AAAS and Current Plans for a Second Cooperative Meeting in 1949."
Ralph W. Lefler, Purdue University, West Lafayette, Ind.

"Report on the Teaching Aids Research Studies of the Advisory Council on Industry-Science Teaching Relations."
Morris Meister, Bronx High School of Science New York, N. Y.

"Consultation Service:A Professional Activity of N.S.T.A."
Robert H. Carleton, National Science Teachers Ass'n., Washington, D. C.

"Toward a More Dynamic Journal for N.S.T.A."
Hanor A. Webb, George Peabody College for Teachers, Nashville, Tenn.
John Chiddix, Editor *The Science Teacher*, Normal, Illinois.
Departmental editors *The Science Teacher*

"Toward a More Functional Constitution for N.S.T.A."
Norman R. D. Jones, Southwest High School, St. Louis, Mo.
Members N.S.T.A. Constitution Revision Committee

THIS AND THAT

Continued from Page 78

Nebraska; Ralph Lefler at Indianapolis; James G. Harlow at Oklahoma City; Ray E. Gilbert at Salt Lake City; Robert H. Carleton at Washington, D. C.; Dr. Hanor A. Webb at Atlanta; and Dr. Paul E. Kambly at Spokane. All reported very fine meetings held by N.E.A. Regional Conferences on Teacher Education and Profssional Standards.

Dr. Charlotte Grant represented N.S.T.A. at the National Conference For Cooperation in Health Education.

Premedical Education Conference

Many of you in Pennsylvania and New York will want to attend the Third Regional Conference on Problems of Premedical Education at the University of Syracuse on May 6 and 7, 1949, sponsored by Alpha Epsilon

Continued on Page 99

A National Science Day, or Week?[1]

LEE R. YOTHERS
Rahway High School, New Jersey

The National Science Teachers Association is studying the advisability of putting the following proposal into effect: "Shall N.S.T.A. take the lead in proposing and sponsoring a science public relations program to be observed during 'A National Science Day' or 'A National Science Week' in the United States?"

This program was presented to the Association with the view to accomplishing the following major objectives: (1) to promote science and the science profession on a national basis, (2) to enable the scientists to become better acquainted with each other and one another's work, (3) to honor the workers in the various fields of science, and (4) to acquaint laymen with the contributions of pure and applied science. Too frequently they learn of science only in connection with atomic bombs and other destructive agents. They should know also that scientific minds and laboratories are constantly at work devising and producing for their comfort and health such items as pop-up toasters, thermostats, deep-freeze units, television, and penicillin. The better acquainted laymen become with science, the more value it has for them, and the less biased they are toward it and society.

These questions may be asked: (1) to whom should responsibility be delegated for this program and (2) what promotional aids would be available to teachers? Obviously, the program's success would depend upon inclusion and cooperaiton of all science organizations. Ultimately, the success of this project would rest upon the individual science teachers throughout the nation. Pamphlets describing programs suitable for class room use, science assemblies, night science meetings, service clubs, womens clubs, etc., could be made available. Other avenues for observing such an occasion would include science articles in local newspapers by teachers and other technically trained men and women in the community, radio networks, and news releases.

We, who work in science, are aware that the record of scientific achievement is a commendable one. Few professions offer a comparable galaxy of notable men and women, both past and present, who have and are contributing to man's well being. Why, then, do not we science teachers pay honor to our profession and its workers and, at the same time, direct our efforts toward increasing an understanding of the practicability of scientific methods and products to laymen.

A committee has been appointed by N.S.T.A. to determine the feasibility of this program, and to submit a report at the Boston meeting in July, 1949.

To bring this matter to the science teachers over the nation, editors of science journals have been invited to assist the committee by giving magazine space to this brief article and questionnaire. Specifically, the committee wishes to learn the attitude of science teachers in the United States regarding this project. EVERY READER OF THIS JOURNAL FROM KINDERGARTEN THROUGH THE UNIVERSITY IS, THEREFORE, URGED TO CONTACT A MEMBER OF THE COMMITTEE AND EXPRESS HIS OR HER OPINION REGARDING THE DESIRABILITY OF THE FOLLOWING: (1) a National Science Day, and (2) a National Science Week. Also, would you assist by supporting and promoting such a program in your local school system and community? The committee members are as follows:

1. Dr. Earl R. Glenn
   State Teachers College
   Upper Montclair, New Jersey
2. Dr. Walter S. Lapp
   724 Derstine Avenue
   Lansdale, Pa.
3. Mr. Lee R. Yothers, Chairman
   Rahway High School
   Rahway, New Jersey.

1—For additional data see: The Science Teacher, February, 1946, p. 18.

Audio-Visual Aids

Edited by CHARLES R. CRAKES

The editor of this department will attempt to bring before the readers of this publication the latest articles written by science teachers who are making effective use of various forms of audio-visual teaching materials. He will also endeavor to present a cross-section of educational opinions on audio-visual aids he may gather in travelling about North America.

Mr. Myron F. Boyer, the author of the article "Audio Visual Aids for Ninth Grade Science," now serves as instructor of 9th grade general science and Director of Audio Visual Aids in the Muhlenberg Township High School, Laureldale, Pennsylvania. Mr. Boyer holds a Bachelor of Science degree from the Kutztoun State Teachers College with a major in science and Social Studies. He has also done graduate work at Pennsylvania State College and Temple University. For the past 23 years he has been connected with the Muhlenberg Township School District.—C. R. Crakes.

Audio-Visual Aids for Ninth Grade Science

MYRON F. BOYER

Muhlenberg Township High School
Laureldale, Pennsylvania

THE USE of audio visual aids in the presentation of science material is a *must.* In fact, for those students that are slow thinkers and whose comprehension is below average we might say it is "food for the backward." Visual material stimulates interest and supplements lectures, demonstrations, and textbooks. Even average and above average groups will gain a better understanding of the subject matter taught.

However, we must caution against the misuse of these tools. Audio visual material cannot supplant the teacher or the textbook; material to be shown must be correlated with the topic under discussion. The teacher should be familiar with the contents of all materials used. There should be a discussion period following the showing of the film or other aids to definitely correlate their materials.

Films should never be used with other teaching media in the classroom for entertainment, but as a contributing teaching device in getting across the objectives of the science curriculum. Films or other audio-visual aids must be presented at the proper time and in conjunction with the work on that particular topic in order to drive home to the learner facts to be learned.

IN OUR ninth grade science program, we use all the films marked with a star (*). Most of these are obtained from the film library at the State Teachers College, Kutztown, Pennsylvania. Others mentioned may also be used. The filmstrips mentioned are a part of our own audio visual aid department. The following are the twelve units of work in our ninth grade science program:

Unit I. Environment—Matter—Energy—Power—Industry—Work—Machines.

Films:
- *Simple Machines EBF 1942 (1)
- *Energy and Its Transformation EBF 1933 (1)
- What is Science COR 1947 (2)
- Matter and Energy COR 1947 (2)
- Science and Superstition COR 1947

Filmstrips:
- *Energy VTS (3)
- *Energy VS (4)
- *Pulley VS (4)
- *Inclined Plane VS (4)
- *Lever VS (4)
- *Ocean Passenger Transportation JMC (5)
- *Ocean Freight Transportation JMC (5)
- *Railroad Transportation JMC (5)
- *Roads and Road Making JMC (5)
- *River Transportation JMC (5)
- *Lake Transportation JMC (5)
- *Global Concepts and the Age of Flight SVE (6)

*Coast to Coast Geography from the Air SVE (6)

Unit II. Air

Films:

*Work of the Atmosphere EBF 1935 (1)

*Problems of Flight EBF 1941 (1)

*Theory of Flight EBF 1941 (1)

Filmstrips:

*Air VS (4)

*Dead Reckoning JH (7)

*Pilot Problems JH (7)

*Behind the Scenes of Coast to Coast Flight SVE (6)

Unit III. Sound

Films:

*Sound Waves and Their Sources EBF 1933 (1)

*Fundamentals of Acoustics EBF 1933 (1)

Filmstrips:

*Sound VS (4)

Unit IV. Water

Films:

Properties of Water COR 1945 (2)

*Clean Waters GE (8)

Water Cycle EBF 1947 (1)

*Work of Rivers EBF 1935 (1)

*Work of Running Water EBF 1931 (1)

*The River C 1937 (9)

Filmstrips

*Water VS (4)

Unit V. Heat

Films:

*Fuels and Heat EBF 1938 (1)

*Distributing Heat Energy EBF 1938 (1)

*Thermodynamics EBF 1938 (1)

Filmstrips:

*Heat VS (4)

Unit VI. Light

Films:

*Light Waves and Their Uses EBF 1937 (1)

Filmstrips:

*Light VS (4)

Unit VII. Human Body—(Food—Digestive System—Micro-organisms)

Films:

*Digestion of Foods EBF 1938 (1)

*Alimentary Tract EBF 1938 (1)

Filmstrips:

*Micro-organisms and Disease JMC (5)

Unit VIII. Electricity

Films:

What is Electricity W 1944 (10)

Introduction to Electricity COR 1948 (2)

*Principles of Electricity GE 1945 (8)

Magnetism COR 1947 (2)

*Electrons EBF 1937 (1)

Jet Propulsion F GE (8)

Filmstrips:

*Atomic Bomb AFPC 1946 (11)

*Current Electricity VS (4)

*Magnetism VS (4)

*Telephone JMC (5)

*Telegraph JMC (5)

Unit IX. Our Universe

Films:

*Geological Work of Ice EBF 1935 (1)

*Mountain Building EBF 1935 (1)

*Volcanoes in Action EBF 1935 (1)

*Wearing Away of the Land EBF 1931 (1)

Unit X. Solar System

Films:

*The Solar Family EBF 1936 (1)

*The Earth in Motion EBF 1936 (1)

Unit XI. Weather

Films:

*Weather EBF 1942 (1)

Filmstrips:

*Air Masses JH (7)

*Weather JH (7)

Unit XII. Living Things—(Green Plants—Agriculture—Introduction to Biology)

Films:

*Plant Growth EBF 1931 (1)

*Roots of Plants EBF 1931 (1)

*Flowers at Work EBF 1931 (1)

*Seed Dispersal EBF 1931 (1)

*Story of Human Energy CPRC 1948 (12)

*A Gift of Green NYBG 1946 (13)

The Birth of the Soil EBF 1948 (1)

This Vital Earth EBF 1948 (1)

The Arteries of Life EBF 1948 (1)

Seeds of Destruction EBF 1948 (1)

Key: Dates represent the year in which the material was produced. Sources of Films and Filmstrips are as follows in the order listed in the above outline:

1. EBF Encyclopaedia Brittanica Films, Inc.
   1150 Wilmette Avenue
   Wilmette, Illinois
2. COR Coronet Instructional Films
   65 E. South Water Street
   Chicago 1, Illinois

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Films and Film Strips

Your editor has recently previewed several excellent science films and film strips.

AIR ALL AROUND US—A ten minute sound film in B & W, produced by Young America Films, Inc., 18 E. 41st Street, New York 17, New York. This film, one of the Elementary Science Series, presents and explains a number of classroom demonstrations illustrating concepts concerning air pressure, contraction and expansion of air, and compressed air. Technical advisers: Dr. Gerald S. Craig, Teachers College, and Dr. Helen B. Warrin, Newark Schools. Recommended for elementary school science.

THE FLOW OF ELECTRICITY—A ten minute sound film in B & W by the same producer. Designed as one of the Elementary Science Series, this film explains the factors which affect the flow of electricity through a simple electrical circuit, introduces the electron theory, and shows the application of a simple circuit in a home situation. The film is built around the inquiries of Betty and Bob. Technical adviser: Dr. Gerald S. Craig, Teachers College. Recommended for elementary school.

MOLECULAR THEORY OF MATTER—A ten minute sound film in B & W produced by Encyclopaedia Brittanica Films, Wilmette. Illinois. Develops inductively the theory that all matter consists of molecules in motion. Portrays molecular aspects of the diffusion of gases in air and vacuum, condensation of steam, evaporation of liquids, and transformation of liquids into solids. Explains force exerted by molecules in motion by using impressive machine gun analogy. Microscopic photography discloses Brownian movement a direct evidence of molecular motion. For high school and college chemistry, physics and general science and for adult groups.

MOTHS—A ten minute sound film, B & W, by the same producer. Traces the four developmental stages in the life cycles of the silk and the white marked tussock moths. Portrays, through close-up photography, the caterpillar (or larva) eating its way out of the egg, feeding, molting, and weaving its cocoon; and the moth as it emerges from the cocoon. Also it directs attention to the economic importance of moths. For elmentary science, high school general science, biology, and agriculture and for adult groups.

THE BODY FIGHTS BACTERIA—A ten minute sound film, B & W, produced by McGraw Hill Book Company, Text-Film Department, 330 W. 42nd Street, New York. Shows how the body builds up defense against diseases. The process of immunization or vaccination is simply and clearly explained. The film is excellent for use in teaching health education.

FILMSTRIPS

A series of nine (9) filmstrips in color for intermediate science classes produced by the Charter Oak Films, New Haven, Connecticut.

WHAT IS IN THE SKY
HOW OUR EARTH BEGAN
ABOUT OUR EARTH
OUR EARTH IS MOVING
OUR CHANGING EARTH
THE BEGINNINGS OF LIFE
ANIMALS OF LONG AGO
MAN OF LONG AGO
PARTS OF A FLOWERING PLANT

BACTERIA—A 42 frame filmstrip produced by Young America Films, Inc., 18 E. 41st Street, New York. Explains the different kinds of bacteria, the harmful and the helpful. Describes the precautions that should be taken to prevent and control the spread of harmful bacteria.

MAGNETS—A 48 frame filmstrip by same producer as named above. A filmstrip demonstrating some of the essential facts about the nature and behavior of simple bar magnets. Built around the activities of two children who learn what a simple magnet is and some of the things it can do. Designed to be used independently or in conjunction with the film of the same title. Recommended for elementary school science.

MOTION PICTURE FILMS

CARBON AND ITS COMPOUNDS—A ten minute sound film, B & W or color produced by Coronet Films, Coronet Building, Chicago, Illinois. A diamond . . . a pencil . . . and a chunk of charcoal. Beginning with these famaliar objects, this film explains carbon's

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A Change for High School Botany

JOSEPH P. McMENAMIN
Oak Park High School, Illinois

IT IS NO news that high school botany has been on the decline for several decades. Statistics show that it is taught in less than ten per cent of our secondary schools today. Students have lost interest in it. Certain factors contributing toward this decline have been discussed by a Detroit instructor, A. Lynn Zwickey, in a paper—"Why Are Students Not Interested in Botany?", 1946[1]. The concern of the laymen and parents has been crystallized in another thought provoking article, "Should Your Child Study Botany or Gardening?", 1947[2].

It is evident that the writer, a teacher of botany, has reason to look upon himself as a "species" of high school instructor facing extinction. Could it be that we of this particular "species" are partly to blame ourselves, that we are like the passenger pigeons who are said to have met extinction partly because of their tendency toward over-specialization?

The purpose of this paper, however, is not to analyze the present status of high school botany but to offer some ideas toward remedying a sad situation. It is assumed that botany has much of the practical and useful to offer the high school student today. People are becoming increasingly interested in home gardening, hobby phases of plant breeding, conservation, and antibiotics. For this reason we should make a first course in plant science practical, inspirational, and worth-while. And to help achieve this type of course the following suggestions are offered.

FIRST, we must be more sincere and definite about our goals and objectives. For example, our main objective in teaching recognition and identification should be considered carefully. If our purpose here is to teach and achieve a limited *but useful* recognition, can we afford the time to teach the use of keys which very few students will ever use later? To what extent should we ask students to collect and identify plant collections? Will it not mean more to our students, especially those who do not go on to college, to be able to name with certainty the commonest plants in their environment ten years after graduation rather than to have to discard a large insect-eaten herbarium notebook or collection whose value now seems questionable? If we can clarify our objectives, such as this one just mentioned, we ought to be able to do some straighter shooting at our goals and obtain more worthwhile results. With this in mind the author set down twelve objectives for a new type of high school botany course. Five of them are listed here by way of illustration:

1. A lasting recognition of the commonest plants in the student's local environment.
2. An interesting acquaintanceship with primitive plants and recognition of them at least by their groupings.
3. An accurate recognition of well-known misnamed plants such as Spanish Moss and Asparagus Fern.
4. An increased knowledge of the make-up and functioning of the "modern" plant body.
5. A general understanding and appreciation of plant distribution and vegetational regions.

SECOND, we must make the subject matter much more a part of our students' own everyday happenings. This will make a heavier demand on our time but once it is in effect both students and teacher will find the course more interesting. Our attempts to achieve this worthwhile situation might involve such activities on our own initiative as:

1. Reading and recognizing the inspirational value of the latest popular books in our field; e.g. *Plants*, by Zim. 1947, *Miracles from Microbes*, by Epstein and Williams. 1946. and *Flowering Earth*, by Peattie. 1939.
2. Reading or scanning current technical periodicals to assure the students of our own professional vigor and outlook, e.g. *Economic Botany*, a relatively new and useful journal.
3. Keeping alert for useful teaching material which often appears in new pamph-

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Tired of Selling Science?

JAMES G. HARLOW

Director of High School Science Service, University of Oklahoma

GREEK mythology tells us of Antaeus, one of Hercules' adversaries, who was marvelously endowed for struggle. In the first place, he was a giant, but his richest endowment lay in the fact that Earth was his mother, so that every time he was thrown down, he was instantly renewed in strength and vigor. This situation made him so successful that he finally was able to build a castle from the skulls of his victims.

There's a good Mother Earth in an intellectual sense for us science teachers in the recent "Science and Public Policy," the report of the President's Scientific Research Board. You'll find that it can be returned to again and again, and that each time you'll be reinvigorated, rededicated to the task of science teaching and rearmed for that tough selling task.

The fact is that in our nation, science has shifted from the deliverer of the good things of life to the producer of the bread and meat of existence itself. Added to this, we suddenly find that science has become the central item in the war-making ability of our nation. The development of these ideas is the burden of "A Program for the Nation," Volume One of the Report (20 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.)

THE REPORT opens with a trenchant and vigorous statement of the place which science now plays in the United States:

> "The security and prosperity of the United States depend today, as never before, upon the rapid extension of scientific knowledge. So important, in fact, has this extension become that it may reasonably be said to be a major factor in national *survival*."

If the Scientific Research Board is accurate in its estimate— and it ought to be accurate, for its membership includes four cabinet officers and nine senior administrative heads of large governmental units—one can derive from the quotation above a most challenging mission for science teaching in the United States: the development of both the individuals and the public support necessary to the "extension of scientific knowledge." Viewed in the light of the position taken by the Report of the President's Scientific Research Board, this is no subject-matter mission, aimed toward the improvement of science instruction for the sake of science, unadjusted to the life needs of school children. It is rather, a society-centered mission of first importance, the task of helping the individual members of the social order to understand the nature of their economic structure and their national military strength.

Volume One continues with discussions of the national research and development budget, scientific manpower, a proposal for a national science program, and the present place which science activities hold in governmental affairs.

Volume Four of the same report, titled "Manpower for Research," attacks the personnel phase of the problem of science in our social order. This booklet (35c, from the Superintendent of Documents) will give you a good bit of professional reading of a more clearly educational flavor, for, in addition to its discussion of the war-caused shortage of scientists, it includes a report from the AAAS Cooperative Committee on The Teaching of Science and Mathematics. The Committee included among its membership, NSTA members Dr. Morris Meister, of the Bronx High School of Science, New York, and Dr. R. W. Lefler of Purdue University. The report also acknowledges assistance from other NSTA members: Glenn O. Blough and Dr. Philip G. Johnson of the Office of Education, Dr. G. P. Cahoon of Ohio State University, and Dr. S. R. Powers of Columbia University.

In the *Introduction* to the AAAS Committee report, you can find this statement—powerful support indeed for the efforts of the science teacher:

"This is the age of science. The technological aspects of science, because they confer power and have a popular appeal, are highly

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News and Announcements

ILLINOIS CHEMISTRY MEETING

A meeting of the Illinois Association of Chemistry Teachers at Belleville High School, May 13 is announced by its president, C. W. Dewalt of Glen Ellyn. In the morning there will be a field trip to Aluminum Ore or Monsanto Chemical Company plant. Among other things in the afternoon will be a discussion of a state science teachers' association.

GREATER ST. LOUIS SCIENCE FAIR

The second Greater St. Louis Science Fair showed an increase of 50 per cent over the previous one according to information received. There were 1,469 entries by 2,677 pupils. To the winners in each division were awarded five scholarships totaling about $7,500 and cash prizes amounting to $2,100. The fair was conducted by the Science Teachers Committee of Greater St. Louis Schools and was sponsored by the St. Louis Star-Times.

JUNIOR ACADEMY CAREER DAY

A *Career Day* is being sponsored by the Missouri and St. Louis Junior Academies of Science on April 30 for science pupils in grades nine through twelve. They will meet at the St. Louis University High School where they listen to discussions of the opportunities offered by any of fifty or more occupations allied with the field of science.

COLGATE UNIVERSITY

Colgate University announces its regular summer session of six weeks starting July 5, 1949. Among its many offerings will be general courses in several sciences, a core course in science stressing the understanding and social implications of science, and also an inter-departmental course in general science illustrating laboratory and field study techniques in the several sciences.

PLEASURE WITH PLANTS

The Illinois Natural History Survey, Urbana, Illinois, announces the publication of a revised edition of "Pleasure with Plants.' Written by Dr. L. R. Tehon, Head of the Section of Applied Botany and Plant Pathology, the circular gives information about the how, when, and where to start botanizing; advice about equipment, and books necessary to the starting of a collection; and procedures to follow in classifying and preserving specimens.

S. V. E.

The Society for Visual Education, Inc., has added to their library of 2″ x 2″ slides and 35 mm. filmstrips two new filmstrips; one set in the "Foundations of Chemistry Series" and another set in the "Human Biology Series." The Chemistry Series provides for a clear, concise conception of basic chemical terms and formulas in ten strips. The Biology Series visualizes the organ and workings of the digestive, respiratory, circulatory, glandular, and nervous system in five filmstrips.

CANCER

Chemical changes in sugar and mold may be a key to knowledge of cancer. That is the hope of Dr. Jackson W. Foster, University of Texas bacteriology professor. He is studying intermediary stages in the conversion of sugar into by-product chemicals and chemical activity in molds. In some molds the chemical changes are a lot like those of malignant tissues, he says.

313th PATENT

Dr. Ernst F. W. Alexanderson, General Electric scientist, has been issued his 313th patent for a radio landing apparatus, developed in collaboration with Franklin G. Patterson of the General Engineering and Consulting Laboratory. By means of this device a visual representation of marker beacons lining airport runways is reproduced on an oscilloscope within the pilot's cockpit. Dr. Alexanderson has averaged one patent every seven weeks since joining General Electric forty six years ago.

ELECTRON MICROSCOPY

University Extension, University of California at Los Angeles, is offering this semester as a part of its adult education program, a course Fundamentals of Electron Microscopy.

A CHALLENGE TO YOUTH

Benson Ford, vice-president of the Lincoln-Mercury division of the Ford Motor Co., has outlined five areas of challenge for the young people of his generation. These areas are as follows: (1) learn to think politically—to understand the public interest, (2) approach the eternal problems of peace, security, and tolerance with fresh viewpoints and vigorous, new solutions, (3) strike a better balance between the moral and the material in our daily lives, (4) think internationally—learn to speak the languages of other people, literally and figuratively, and (5) improve our methods for distributing goods to match our supremacy in producing them.

BIOCHEMICAL PREPARATIONS SERIES

John Wiley and Sons have announced a new series of annual volumes on the preparation of biochemical compounds to be known as the "Biochemical Preparations Series." Volume I, edited by Herbert E. Carter of the Department of Chemistry, University of Illinois, was published on February 15. New volumes in the "Biochemical Preparations Series," incorporating the latest information in the field, will appear at yearly intervals. Volume II, scheduled for 1950 publication, is being edited now by Dr. R. R. Sealock, Department of Chemistry, Iowa State College, Ames, Iowa. Biochemists are invited to send contributions for the second volume directly to the editor-in-chief.

DIFFUSION IN METALS

Scientists of the General Electric Research Laboratory announced that radioactivity is being used to trace the movement of atoms in metals. In a recent experiment, it has been found that silver atoms within a block of silver may move between the grains as fast as one tenth of an inch per week at 500 degrees centigrade. However, atoms passing through rather than around the grains take about 10,000 years to move an inch, according to the scientists. The scientists are conducting these studies in order to learn more about the internal structure of metals. Behavior of the atoms making up a metal determines what characteristics the metal will have. The scientists hope to be able to design metals for specific jobs, just as bridges are now designed.

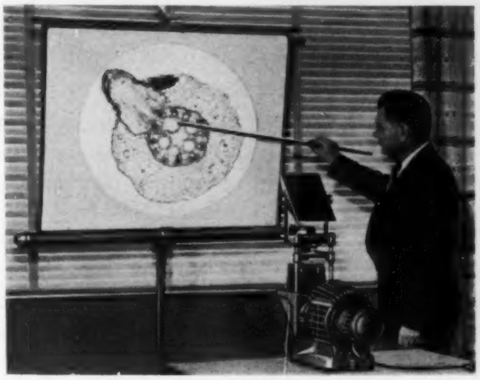
PURDUE UNIVERSITY WORKSHOP

Purdue University dedicated the M. W. Welch and R. E. Welch Science Teachers Workshop on January 8, 1949. Teachers Workshop material was presented by M. W. Welch and R. E. Welch of W. M. Welch Scientific Co., Chicago, Illinois. R. W. Lefler, Department of Physics, was in charge of the workshop. Louis M. Stark, Manager, School Service, Westinghouse Electric Corp., gave an address entitled, "The Enrichment of Science Instruction," and C. H. Robertson, Department of Physics, Purdue, gave an address entitled, "The Experiment in the Teacher Training Program."

A NEW DEVICE

A new inexpensive micro-projection device has been announced by Keystone View Company for use with their Overhead Projector. It can be substituted in a few minutes for the standard objective lens and makes possible very sharp projection of microscopic objects.

An inexpensive attachment is used to give clear, sharply defined enlargements with Keystone overhead projector.



NEW PUBLICATION

A *Bibliograph of Articles Concerning Conversion of War Surplus Equipment for Civilian and School Use* has been prepared by Willis C. Brown, Assistant Specialist for Aviation, Office of Education, Federal Security Agency, Washington 25, D. C.

Indexed are 69 sources and articles relating to "how to convert" specific war surplus equipment for civilian and school use. The four-page mimeographed list is available free from the above address.

SCIENCE IN JAPAN

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Science Education Research Rooms

THE SCIENCE education research rooms financed by government funds and developed within twenty-three universities and higher technical schools throughout Japan are an effective means of helping teachers grow in science education, especially in understanding the scientific method. Selected teachers from the vicinity of one of the higher educational institutions come for three to six months of work with the professor or groups of professors responsible for the science education research room. Under guidance, each teacher carries on a research project in the field of his interest. He attends courses related to his research problem or to his teaching. In some of the centers, teachers participating in the program meet regularly to discuss the research they are doing. The science education research room at Hiroshima University has a laboratory in which teachers can work out demonstrations for their students, and can make use of reports by their predecessors, sample textbooks, periodicals on science and science teaching, and other curricular material.

Science Textbooks

Another important aspect of the work in elementary and secondary science in Japan has been the development of suitable text material in spite of the paper shortage. The first act at the beginning of the occupation was the deletion from all textbooks of any material on ultra-nationalistic or militaristic nature. The resultant science textbooks may be described as containing abstract factual material often presented with excessive wordiness. A review of them fails to show critical thinking and scientific attitudes as important aims.

SINCE textbooks were all centrally developed, it was possible to work intensively with the science text compilers of the Ministry of Education in developing new textbooks. The resultant series of general science texts for grades four through nine is a series that would compare favorably with those in the United States. The unit texts may be described as having the following characteristics:

1. They encourage problem solving directly and through exemplifying it.

2. They present material directly and interestingly rather than abstractly and obtusely.

3. Everyday applications and experiments are an integral part of the text material since study of science in school and outside of school are both parts of children's living.

4. Textbooks are checked for scientific accuracy and for the avoidance of superstition.

5. Multicolored illustrations and covers designed by leading artists make the books highly attractive in contrast to earlier texts having few illustrations only in black and white.

6. The texts are in keeping with the new curriculum planned for continuous development of pupils understanding, critical thinking, attitudes and skills in science.

7. Besides the unit texts available one for each 10 students, each child has a booklet for recording experiments and observations.

Decentralization of Textbook Production

During the past year the production of text books has been decentralized. Private publishers rather than the Ministry of Education produce textbooks with the assistance of competent scientists and science educators. The Ministry of Education personnel who formerly wrote texts, now work with any and all publishers and text writers in developing the best possible texts for the boys and girls.

Conclusions

During the occupation, elementary and secondary science teaching has moved ahead rapidly. Curriculum work has been advanced locally, prefecturally, regionally, and nationally. Curricula in science, science textbooks and other curricular materials are being developed by interested groups of teachers. Science education research rooms help selected teachers supplement limited preparation with experience in problem solving. Conferences and demonstrations of teaching further teacher growth in service. The new course of study and its subsequent revisions also improve science teaching. In short, elementary and secondary school teachers now have leaders familiar with and well started in the use of methods for continuously improving science teaching in Japan.

AUDIO-VISUAL AIDS

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3. VTS Visual Text Sales Company
   Los Angeles, California
4. VS Visual Sciences
   Suffern, New York
5. JMC John Muir Company
   Philadelphia, Pennsylvania
6. SVE Society for Visual Education
   100 E. Ohio St.
   Chicago, Illinois
7. JH Jam Handy Organization
   2821 E. Grand Blvd.
   Detroit 11, Michigan
8. GE General Electric Company
   Vis. Ed. Service
   Schenectady 5, New York
9. C Castle Films
   30 Rockefeller Center
   New York 20, New York
10. W Westinghouse Electric Corp.
    Pittsburgh 30, Penn.
11. APFC Armed Forces Photo Co.
    2001 O Street, N. W.
    Washington, D. C.
12. CPRC Corn Products Refining Co.—
    Distributed by
    Princeton Film Center
    Princeton, N. J.
13. NYBG New York Botanical Gardens—
    Distributed by
    Modern Talking Picture Service, Inc.
    New York City 20, New York.

IN ADDITION to the above mentioned films and filmstrips we use specimens of plants, rocks, cross-sections of machinery, etc. We use laboratory demonstrations to illustrate and apply the laws of science in seeking information to solve the problem. This involves equipment. The use of models, such as globes, eye, ear, etc., is also helpful.

Illustrating our science units are the 32 charts published by the A. J. Nystrom Company and edited by Davis and Smith.

Mounted flat pictures obtained from magazines are carefully catalogued according to the unit ready for use when needed.

The blackboard is still a very necessary visual aid. Its use for graphs, drawings, and explanations relative to the student's assignment is effective for learning.

Furthermore, many charts, booklets, exhibits, and specimens can be obtained from manufacturing concerns and if carefully screened can be used in your daily work. General Electric Company and Westinghouse Electric Corporation have a great deal to offer, especially in the field of electricity.

THERE is an abundance of material available. Let us acquire it and put it to work. It will help to awaken and arouse interest in those students who must but do not desire to take a required course in science. All students will show a greater appreciation for the study of science.

MOTION PICTURE FILMS

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simple compounds and introduces hydrocarbons and the more complex chain and ring compounds. It teaches appreciation and understanding of the many forms and uses of carbon and its tremendous importance in our domestic and industrial worlds.

THE CELL—Structural Unit of Life. A ten minute sound film, B & W or color by the same producer. Here, through amazing microphotography, the living, simple cell is authentically presented. Students actually see the moving, living protoplasm in a leaf cell; see amoeba taking food, growing, dividing: becoming familiar with the functional differences in cell structure. This vivid film unforgettably teaches the basic relationship of our own living bodies to other living organisms in the world.

LIGHT WAVES AND THEIR USES—A ten minute sound film, B & W, produced by Encyclopaedia Brittanica Films, Inc., Wilmette, Illinois. Illustrates principles of reflection and refraction of light. Animated drawings and photographed experiments clarify principles by illustrating refraction through lenses, and reflection from plane, concave, and convex mirrors. Explains the human eye as a lense, depicts use of light waves in making minute measurements, calls attention to interference, electromagnetic spectrum, and principles and uses of polar screens. For high school and college physics, general science and photography and for adult groups.

THE HUMAN SKIN—An 11 minute sound film, B & W, produced by Bray Studios, 729 7th Avenue, New York, New York. Animation and photography combine to show us the anatomical structure and the functions of the skin, an organ which protects us from the outer environment and regulates the temperature of our bodies.

USING NATURE LITERATURE

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our evidence seems to show, it may be that, etc.

The information gained in many instances is essential to life in a democracy, as for example, information about atomic energy, conservation, health practices, and inter-relationships of plants and animals to man. The scientific attitude, too, is essential equipment for democratic life—our ways of arriving at a conclusion, our willingness to consider the point of view of another, our ability to look at a matter from every side—these are but a few of the elements of that attitude. The growth in ability to solve problems, some of which may be gained from books, is also essential equipment for a worthy member of a democratic society.

In this brief space we have looked only casually at the problems involved in using science books with children. Obviously, much remains to be discussed. It is probably fair to say that at present our supplementary science books are not contributing their potential share toward the total development of children and young people because we have not given enough thoughtful attention to the needs they can satisfy and how they can best be used. With the increased emphasis on science we can expect growth in our schools in ability to use science books more effectively so that they can serve for their true worth in building a better world today and tomorrow.

For a discussion of "A New Microscopic Technique Bio-Plastic Whole Mounts" see Ward's Natural Science Bulletin, published by Ward's Natural Science Establishment, 3000 Ridge Road East, Rochester 9, N. Y. The method is discussed in terms of the mounting of chick embryos.

EXPERIMENTS IN ILLUMINATION

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the luminaire. The ratio of the total luminaire lumens divided by the total bare lamp lumen times 100 will give the luminaire efficiency in per cent.

TABLE 1

0-10 degrees	170-180 degrees	0.0954
10-20 degrees	160-170 degrees	0.283
20-30 degrees	150-160 degrees	0.463
30-40 degrees	140-150 degrees	0.628
40-50 degrees	130-140 degrees	0.774
50-60 degrees	120-130 degrees	0.897
60-70 degrees	110-120 degrees	0.992
70-80 degrees	100-110 degrees	1.058
80-90 degrees	90-100 degrees	1.091

TO ILLUSTRATE, consider the bare incandescent lamp whose vertical distribution is shown in Figure 1a. To determine the luminous flux emitted by this source through the 40-50 degree zone, the average candlepower can be found from Figure 1a to be that intensity at 45 degrees, 800 candlepower. From Table 1, .774 steradians are contained in this zone. The luminous flux emitted by this lamp through that zone is .774 times 800 c.p., or 619 lumens.

The luminous flux emitted through other 10 degree zones from 0° to 180° can be found in a similar manner. The total lumens emitted by the source will be the sum of these zonal lumens.

Bibliography

1. J. O. Kraehenbuehl, *Electrical Illumination*. John Wiley & Sons, Inc., New York, New York.

WANTED—PUBLICATION MATERIAL

For the journal ahead we need many kinds of materials on all levels. These include approaches to the study of a unit or problem, activities that have proved useful, experiments, demonstrations, how you do it ideas, special methods, etc. Write us or send in your material.

TIRED OF SELLING SCIENCE?

Continued from Page 85

developed, but the knowledge of how to use this powerful tool is even more important than its possession. The United States now holds the scientific leadership of the world. However, it is a question whether, even in the United States, there is a clear understanding of what science can do for and to mankind. Therefore, we must not only develop a corps of scientists sufficient in number and competence to insure continued progress, but also make a concerted effort for mass education of our citizens in scientific principles and attitudes."

These two booklets, totalling some 235 pages, constitute one of the most concise and authoritative estimates available of the economic and military significance of science in the United States of 1948.

THE REPORT'S need for interpreters places science teachers in a unique relation both to the Report and to their communities. For, with its need for background in its readers, in understanding of the relationships between science and today's social order it is entirely possible that even as serious and as basic a problem as the supply of new scientific ideas may go entirely unnoticed and untreated by our citizenry. The science teachers of the United States constitute probably the only group equipped with both the background and the personal contacts through which the Report can exert its full effect. It is entirely possible that the extent of public school science teacher awareness of the Report and the extent of science teacher support of its recommendations may be the measure of the nation's attack on the basic problem of the "extension of scientific knowledge." In short, are today's science teachers the custodians, in a very large and a very real sense, of the economic health and military strength of the United States of tomorrow? The members of the President's Scientific Research Board and the members of the AAAS Cooperative Committee think so!

In these reports you'll find real stimula-

tion for tomorrow's task together with a new sense of dignity in your calling and personal responsibility to your time.

INSERVICE TRAINING

Continued from Page 66

a grave need, therefore, for the summarization and distribution of cogent bits from significant articles, and of practical findings and conclusions from reports of significant investigations. The contributions to be disseminated need to be carefully screened and so succinctly digested that each can be read in a few minutes. They should be prepared for the typical classroom teacher—not for the researcher and scholar in the field. They need to be distributed frequently. Also, they need to be made available to all free of charge, because only thus can they reach all who need them.

IT WOULD seem that the only realistic and practicable plan for preparing such materials would be to have a paid expert undertake this work as a part-time, or even a full-time assignment. No individual and no committee, however zealous and professionally inspired, could be expected or counted upon to carry on such a laborious task indefinitely, if at all, on a voluntary basis. The expert to perform this major service should probably be furnished by the Federal Security Agency for what other agency could supply the salary of the specialist needed for such an undertaking?

The five suggestions for inservice training here briefly presented would seem to merit wide consideration and extensive try-out. No doubt there are other means of improving the teacher on the job, which offer equal or greater potentialities for preventing or terminating professional dormancy.

HIGH SCHOOL BOTANY

Continued from Page 84

lets such as "How to Grow and Bloom House Plants Successfully," by Wall, 1946, or in such magazines as *Better*

Homes and Gardens or *The Home Garden.*

4. Getting out into the various applied fields and asking for opinion and advice; e.g. talking with a landscape architect or plant nursery superintendent, enrolling in an arboretum course, learning first-hand about practical problems in greenhouse operating, in other words, keeping open-minded and making good use of non-academic but worthwhile information.

THIRD, we need to reorganize our course material into definite units of work designed to emphasize and concentrate on our specific goals. The author has attempted the following two-semester schedule with an increasing measure of success. This schedule is now in its third year trial:

First Semester, *The Seed Plants*, comprised of five units.

1. Summer Weeds and Wildflowers	2 weeks
2. Plant Distribution	4 weeks
3. Make-up of the Modern Plant Body	6 weeks
4. Gymnosperms	3 weeks
5. House Plants and Plant Families	2 weeks

Second Semester, *The Plant Kingdom*, comprised of five units.

1. Organization and Recognition	1 week
2. Bacteria and Fungi	3 weeks
3. Primitive Green Plant Groups	5 weeks
4. Modern Botanical Achievements	3 weeks
5. Cultivated Shrubs and Spring Wildflowers	3 weeks

Fourth, we need to correlate our units of work as much as we possibly can with the opportunities offered by seasons, the weather, holidays, available outdoor materials, and customs.

IT IS EVIDENT that some seasonal correlation has been attempted in the above schedule. The first unit, coming in a period of better outdoor weather, provides opportunities for worthwhile field trips if such are feasible.

Some teachers might prefer to work on trees rather than wildflowers in this fall unit. It so happens that trees are studied in the first part of our prerequisite biology course at Oak Park Township High School. The gymnosperm unit scheduled during the Christmas season claims greater interest when studying local conifers. Christmas tree conservation becomes a more meaningful topic. House plants will probably offer most interest after the Christmas holidays have focused attention on such plants as poinsettias, cyclamens and Jerusalem cherries. This is an example of the correlation which can be developed throughout the whole course.

In conclusion, four suggestions have been presented to put life and concrete meaning into our high school botany: (1) establishing new objectives, (2) vitalizing the subject matter, (3) reorganizing the course, and (4) correlating when possible. Whether our course will disappear entirely from the American high school or take on new life and value in the eyes of students and educators depends

to a large extent upon us of the waning "species."

References

1. Zwickey, A. Lynn, 1946, "Why Are Students Not Interested in Botany?" *Metropolitan Detroit Science Review* 7:36-39.
2. Aves, Helen, 1947, "Should Your Child Study Botany or Gardening?" *House Beautiful* 89:153-154.

THIS AND THAT

Continued from Page 79

Delta, national premedical honor society.

Membership

N.S.T.A. paid memberships have now passed the 4,000 mark, which is a nice increase over last year. Why not check your colleagues to see whether they renewed their memberships or became a member this year? If not, please urge them to do so.

Inquiries—Then Action

Numerous inquiries have come to the Headquarters Office for copies of recent courses of study, syllabi, and other curricular materials. Why not write up the forward-looking work going on in your school or school system and send your report to the Executive Secretary for use in giving helpful replies to others engaged in similar tasks?

Our 1949 Christmas meeting with the A.A.A.S. will be held in New York City. The committee is planning another very fine meeting.

PROJECT ACTIVITIES WANTED

Project material is wanted by Science Publications, Normal, Illinois, in the fields of biology, physics and general science. One or more projects may be submitted. For manuscripts accepted the amount paid will vary according to the material. Authors should write for information before submitting manuscripts.

LOW COST MATERIALS

Nuclear Charts. Six lithographed charts 25 by 36 inches, illustrating the important areas of nuclear physics are available at one dollar for the set from the Westinghouse Electric Corporation, 306 Fourth Avenue, Pittsburgh 30, Pennsylvania.

Description of Professions Series. This is a series of seven pamphlets, each containing descriptions of a group of related professions. There are a total of 69 professional fields described.

Each Description contains, for the profession concerned, an occupational summary describing briefly the work performed, discussion of major branches, educational requirements, licensing and registration requirements, and information on professional societies, related fields, and sources of employment.

They may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. at the prices shown below. However, a limited supply is available for free distribution upon request to the National Roster of Scientific and Specialized Personnel, Department of Labor.

The following pamphlets are available: Pamphlet No. 1, *Agricultural and Biological Sciences* (15 cents); Pamphlet No. 2, *Engineering Sciences* (15 cents); Pamphlet No. 3, *Medical Service Occupations* (15 cents); Pamphlet No. 4, *Medical Professions* (10 cents); Pamphlet No. 5, *Miscellaneous Professional Fields* (10 cents); Pamphlet No. 6, *Physical Sciences* (10 cents); and Pamphlet No. 7, *Social Sciences.*

The Sugar Molecule is a publication of Sugar Research Foundation, Inc., 52 Wall Street, New York 5, N. Y. Request that your name be put on their mailing list. It will be of interest on the high school level.

The Amazing Story of 16 mm Sound Motion Pictures is a 16 page booklet in color and beautifully illustrated that does just what its name implies. It is available at 10 cents from the Ampro Corporation, 2853 North Western Avenue, Chicago 18.

Book Shelf

LABORATORY AND WORKBOOK ACTIVITIES IN BIOLOGY. R. Will Burnett, Assistant Professor of Education, Stanford University; and Paul E. Blackwood, Assistant Professor of Science and Mathematics, Central Washington College of Education, Ellensburg, Washington. Silver Burdett Co., New York, 1942. 21x28 cm. Illus.

Laboratory and Workbook Activities in Biology was written to accompany *Biology for Better Living*, Bayles and Burnett. Each of the thirty-five chapters in this workbook are so organized as to give the student practice in logical thinking. Section I, *Drawing on What You Already Know*, is a preliminary self-checking section which permits him to take stock of what he already knows. Section II, *Exploring*, gives reference to books which are pertinent and which will afford enjoyable and profitable reading. Section III, *Doing and Recording*, suggests numerous activities, projects, and investigations for the student to do in order to solve the problems with which the chapter deals. Section IV, *Testing*, affords the student an opportunity to test himself in order to determine the extent to which he has thought through the important ideas and concepts. Space is provided in Section V, *Summarizing*, for careful summaries of problems explored.—B. H.

ACTIVITY UNITS IN CHEMISTRY. Boris Duskin, Hirsch High School, Chicago, Illinois; and Vinton R. Rawson, Senior High School, White Plains, New York. Oxford Book Company, New York, 1948. 342 pages. 21.5x28 cm. Illus.

Activity Units in Chemistry is a combined workbook and laboratory manual, designed to accompany any textbook, or group of textbooks, for the general course in secondary school chemistry. This workbook is divided into twenty units, a relatively large number, which lends itself to greater flexibility as well as testing and review at frequent intervals. The typical unit embodies a well-defined pattern, including a preview, a unit outline, and table of textbook references, experiments, exercises, and one or more tests. The table of textbook references correlates the exercises and experiments with fifteen leading textbooks. Most of the experiments have three-dimensional diagrams to show how the apparatus is to be assembled. There are tests for each of the regular units as well as comprehensive mid-year and final tests. Tests are bound in a separate booklet.

ACTIVITY UNITS IN PHYSICS. John W. Schneck, Riverside High School, Milwaukee, Wisconsin. Oxford Book Company, New York, 1948. 338 pp. 21.7x27.8 cm. Illus.

Activity Units in Physics represents an attempt to produce a workbook which is usable with any modern textbook. This workbook is based on the principle that the learning of facts, laws, and techniques, per se, has little value for the student. Such knowledge becomes truly valuable only to the extent that it can be converted into an active function—that is, used in the solution of problems.

Each unit is introduced by an alphabetical list of concise definitions of the most important terms involved in the work of that unit. Similarly, all the new formulas to be used in the unit are gathered together at the beginning. The sixty experiments included are those the author believes to be most valuable in helping to give the student a good understanding of elementary physics and of the scientific method. Exercise material is unusually abundant. A wealth of questions and problems is provided to cover any phase of the course which the teacher may wish to stress, including such topics as aviation, atomic fission, radio, and radar. Many exercises are supplemented by a group of Honor Questions for the more ambitious students.

HIGHER PHYSICS. E. Nightingale, Senior Science Master at St. Albans School. G. Bell and Sons, Ltd., London, 1948. 808 pp. 21.8x15 cm. Illus. 27 s. 6 d net.

This book is designed for the use of students in the Sixth Forms of Schools. The material is intended to amply cover the ground required for University Entrance Scholarships. In Part I, on Mechanics and Properties of Matter, are included such topics as gyroscopes, elementary theory of flight, Heyl's work on gravitation and Reynolds' work on the flow of liquids. In Part II, on Heat, are included the second law of thermodynamics and its application to surface energy, the change of melting point with pressure, entropy, and forced and natural convection. Part II, on Light and Sound, contains details of experiments on diffraction and interference of short sound waves. Part IV, on Electricity, includes an account of the discoveries which have led to the utilization of atomic energy. —B. H.

A WORKBOOK IN ELEMENTARY METEOROLOGY. Frederick L. Caudle, State Teachers College, Oshkosh, Wisconsin. McGraw-Hill Book Co., Inc., New York and London, 1945. 191 pp. 20x26.5 cm. Illus. $1.24.

Workbook in Elementary Meteorology combines, in one volume, text materials and exercises in weather. Emphasis is placed on applications to aviation. Forty-four units are arranged in four sections of eleven units each. A test of twenty five questions covering the work of the section appears at the end of each section. Each unit contains pertinent, authentic, and up-to-the-minute text material on the subject concerned; there are many illustrations, charts, and sketches. Completion, multiple-choice, matching, and true-false questions enable the student and the teacher to determine how well the subject has been learned. *Elementary Workbook on Meteorology* may be used as the basic text, or it may be used with any standard textbook. There is included a glossary of meteorological terms encountered in elementary meteorology, and following the glossary are tables needed in connection with some of the exercises, and other tables important in weather.

SMALL-FRUIT CULTURE—A TEXT FOR INSTRUCTION AND REFERENCE WORK AND A GUIDE FOR FIELD PRACTICE. James Sheldon Shoemaker, Head, Department of Horticulture, Ontario Agricultural College, Guelph, Ontario. The Blakiston Company, Philadelphia and Toronto, Second Edition, 1948. 433 pp. 16x23.8 cm. 64 Illus.

The material prepared for the original edition, and for the reprintings in 1939 and 1945, has been completely and thoroughly reviewed for this new edition. Practical application, whether for the individual gardener of the commercial fruit grower, is emphasized. A large amount of information has been added: the latest research and experimental work, based on over 150 new references, has been included; many varieties which have come to the fore have been described; the new insecticides, such as DDT, have entered into the insect control rec

ommendations; the discussion on the frozen-pack preservation of berries has been modified and enlarged; and such factors as hardiness and the causes of winter killing of raspberries have been explained.

The new edition has been developed over a period of yars and with the cooperation of men in the profession at many places across the continent, both in the United States and Canada.

OUTLINE TEXT IN BIOLOGY. George I. Schwartz, Department of Biology, Forest Hills High School, New York City. Oxford Book Company, New York, 1948. 314 pp. 13.5x19 cm. Illus.

The Outline Text in Biology is an outline in the sense that it covers the basic subject matter of elementary biology in concise language, reduced for the most part to tabular form and to a simple step by step development of the core content. It has the essential quality of a text in that the material is well rounded and integrated, and can be understood by the student without reference to any other book.

The material is divided into a large number of short chapters or topics. Topics, in turn, are subdivided by means of frequent headings in question form, each focusing attention upon a central point. The book is well illustrated with clear, accurate, informative drawings. In many cases a dramatic or graphic touch has been added to enhance their teaching value. Each chapter or topic is followed by testing material, including both thought questions and objective tests. The appendix contains a scheme of classification of the plant and animal kingdoms, an extensive glossary, a list of famous biologists with short statements of their contributions, and a full index.—B. H.

THE LIFE OF SCIENCE—THE STORY OF THE SHIP. Charles E. Gibson, formerly Lieutenant in the British Navy. Henry Schuman, New York, 1948. 272 pp. 14.7x21.6 cm. $4.00.

This is a saga of the sea written for the "dryest" of dry-land sailors to the "saltiest" sea-dog that has weathered North Atlantic winters and Pacific typhoons; for the innumerable high school lads whose story book wanderings take them around the world to the most exacting of historians. Charles E. Gibson, former Lieutenant in the British Navy, has written this book as a man with a love for ships, their majestic qualities, their beautiful lines, and their temperament, many times a direct parallel of human beings. It is not a book for sailors alone, but one from which students of history, economics, sociology, anthropology, technology and transportation will not only rceive pleasurable hours but also a great deal of excellent knowledge.

PHYSICS FOR ARTS AND SCIENCES. L. Grant Hector, Vice-President and Director of Research and Engineering, Sonotone Corporation; Herbert S. Lein, University of Buffalo; and Clifford E. Scouten, formerly of the University of Buffalo. The Blakiston Company, Philadelphia and Toronto, 1948. 731 pp. 15x21.8 cm. Illus.

The scope of the material covered in this text is that which is ordinarily included in a first year college course in physics. Historical presentation is used only where it appears easier for the student and reasonably accurate for a modern perspective. For the most part modern explanations are given from the start. The presentation of material is based on the assumption that the physical world in which we live can be largely explained by mechanical and electrical concepts. Included in the general field of mechanics are the behavior of ordinary material objects, also the subjects of heat and temperature, the behavior of sound, and many molecular phenomena. In the broad field of electricity are included the ordinary behavior of electricity and also the subjects of magnetism and light. At the end of the text the general subject of nuclear physics is presented.

THE LIFE OF SCIENCE—ESSAYS IN THE HISTORY OF CIVILIZATION. George Sarton, Associate of the Carnegie Institution of Washington, Professor of the History of Science, Harvard University. Henry Schuman, New York, 1948. 197 pp. 15x21.5 cm. $3.00.

The essays making up this volume have been chosen to give both the general reader and the student a better understanding of the history of science, its scope, purpose, and methods. They have been selected from the author's writings over a period of some thirty years. Written by an outstanding historian of science, the essays in this book show by varied and lucid examples, both biographical and topical, that the History of Science is no narrow specialty, but a liberating approach to human culture as a whole.

Harvey, Napier, von Mumboldt, Comte, da Vinci, Galois, Renan, Spencer—scientists or philosophers or historians of science—are brought to life and their roles in the dramatic evolution of science are revealed in this book.

4,000 YEARS OF CHRISTMAS. Earl W. Count, Professor of Anthropology, Hamilton College. Henry Schuman, New York, 1948. 95 pp. 13.5x22 cm. $2.00.

4,000 Years of Christmas is the story of the universal celebration from its pagan roots in ancient Babylonia to our modern period of festivity, gift-giving and worship. Written authoritatively by the son of a missionary and an anthropologist of repute who has contributed widely to learned journals, and written in popular and often poetic language, Dr. Count's book deals with deep reverence with the central figure of Christ. In this very readable and attractive book for the general reader—for adults, for teen-agers—is traced the development of the idea of Christmas, how many different peoples and nations have shaped and transformed it, and its historical movement from Asia Minor across the face of Europe and into America. Unusual Christmas carols, many never before published in English, are found in this book.—B. H.

AN'MALS WITHOUT BACKBONES. Revised Edition. Ralph Buchsbaum, The University of Chicago. University of Chicago Press, Chicago, 1948. 405 pp. 16x23 cm. Illus. $6.50.

This introductory college text, even more than the earlier edition, will make the study of invertebrates in biology a pleasure. It is simply written in non-technical language, yet quite exact in presentation of important facts and principles. It is so beautifully illustrated that even a non-reader would enjoy the book and profit from it. The striking illustrations not only attract the reader, but provide further reason for searching the text. They definitely are well selected to make clear the thought. Some of the pictures in the earlier edition have been replaced by better ones and many others have been included.

A selected bibliography that has been added will prove of value to the student.

MINERALS AND HOW TO STUDY THEM. Third Edition. Edward Salisbury Dana and (revised by) Cornelius S. Hurlbut, Jr. John Wiley and Sons, New York, 1949. 323 pp. 14x21 cm. 386 Illus. $3.90.

In revising this book Mr. Hurlbut has retained

the amateur approach but has given the amateur mineraloligist a greater understanding of the field in a way that will greatly increase his enjoyment of it. His method of presentation is based upon fifteen years of experience in teaching elementary mineralogy at Harvard University.

The book begins by giving an understanding of what a mineral is and how it is formed; then follows with a discussion of crystals, the physical and chemical composition of minerals and methods of identification. Sixteen pages of determinative tables are provided in the back to help the student identify any minerals he may find. Suggestions are given for making a well-rounded mineral collection.

Minerals and How to Study Them should prove valuable both for the classroom and the school library.

NEW DIRECTIONS IN SCIENCE TEACHING. Anita D. Laton, San Jose State College, San Jose, California; and Samuel Ralph Powers, Teachers College, Columbia University. McGraw-Hill Book Company, Inc., New York, 1949. 164 pp. 14x20½ cm. $2.50.

New Directions in Science Teaching presents a survey of the work of teachers cooperating with the Bureau of Educational Research in Science and the progress made in adapting or changing the science curriculum to meet the needs of students from the standpoint of general education. It indicates some of the new perspectives and new knowledge of community needs gained through local studies and attempts to adjust the science course to these needs. It describes new courses that have been developed in specific schools for placing the various sciences upon a more functional basis and also an integration of science with other subject areas. For example it describes the integration of American history and chemistry, a correlation of biology and home nursing, and a core course on human living.

The book will provide a rich source of material for discussion in teachers' groups and method courses. Every teacher who wants to keep abreast of what is being accomplished in the science teaching field will want a copy.

WORKBOOK OF ACTIVITIES AND EXPERIMENTS FOR THE WONDERWORLD OF SCIENCE. 7th and 8th grades. Morris Meister, High School of Science, N. Y. C.; Ralph Keirstead, Bulkeley High School, Hartford, Conn.; Lois Shoemaker, New Jersey State Teachers College, Trenton; and Theodore Benjamin, DeWitt Clinton High School, N. Y. C. Charles Scribner's Sons, New York, 1949. 128 and 256 pp. Illus.

These two workbooks for the seventh and eighth grades are designed for use with the Wonderworld of Science texts and supply useful activities and directions for important learning activities. The questions and illustrations are of a challenging nature that will provoke thinking and lead to desirable understandings. Tests are included.

Teachers will find the books useful and time savers in handling the day's work.

FREE AND INEXPENSIVE LEARNING MATERIALS. Division of Surveys and Field Services, George Peabody College for Teachers, Nashville, Tennessee, 1949. 175 pp. 15x23 cm. $.25.

This book lists a wide selection of free and inexpensive materials that can be used advantageously in the school curriculum. The material has been evaluated on the basis of content, timeliness of subject matter, and method of presentation. Material that does not meet a suitable standard is not included. Only a few of the items cost more than

fifty cents. The book will be found very useful both in the elementary and high school, particularly in science and the social studies.

ORGANIC CHEMISTRY—Third Edition. Hugh C. Muldoon, Dean of the School of Pharmacy, Duquesne University. The Blakiston Company, Philadelphia, 1948. 648 pp. 14x23 cm. Illus. $5.50.

This third edition of *Organic Chemistry* has been thoroughly rewritten, enriched, expanded, and modernized in keeping with new developments, particularly in the fields of pharmacy and medicine.

There has been some change in the sequence of topics; more equations are used; and additional material has been included in the discussion of proteins, carbohydrates, antibiotics, vitamins, hormones and steroids.

Like earlier editions, the book provides a full year's course in fundamental organic chemistry with special applications to the medical sciences. It will help active practitioners in the field of medicine, pharmacy and nursing to keep abreast of what is new. As a reference, it will be of special interest in relation to chemicals used in medicine.

SONS OF SCIENCE—THE STORY OF THE SMITHSONIAN INSTITUTION AND ITS LEADERS. Paul H. Oehser. Henry Schuman, Inc., New York, 1949. 220 pp. 15x21.5 cm. $4.00.

This book relates for the general reader the life-story of the Smithsonian Institution through the six or eight great figures who have steered its course and have made it one of the world's leading cultural and scientific centers. The general reader can now read its absorbing history in *Sons of Science*, a story that begins with the generous and humanitarian bequest of the British chemist, James Smithson, an ardent sympathizer with the young democratic movement in the United States. Here also are colorful biographies of Joseph Henry, the great physicist; Spencer Fullerton Baird, biologist; George Brown Goode, museum expert; Samuel Pierpont Langley, world-known astronomer and pioneer in "flying machines"; Charles Walcott, geologist; Charles Greeley Abbott, physicist and astronomer; Alexander Wetmore, ornithologist and Smithsonian Secretary since 1945.

INTRODUCTION TO GENETICS AND CYTOGENETICS. Herbert Parkes Riley, Head, Department of Botany, University of Kentucky. John Wiley and Sons, Inc., New York, 1948. 596 pp. 15 x 22 cm. $5.00.

Genetics and Cytogenetics is a well-organized scholarly text on the college level. The treatment features the cytological approach to genetics with stress being placed on general principles rather than practical applications. (The illustrations have been drawn from both the plant and animal kingdoms.) The basic principles of biological inheritance are discussed along with statements and explanations to show the importance of those principles to man, to the improvement of plants and animals, and to organic evolution.

The text is rich in references to human biology, and the emphasis on principles and the variety of illustrations, pictures and tables should make the book of value to students of agriculture, psychology, and sociology. It could also serve as a foundation for advanced work in genetics and cytogenetics. —R. E. D.